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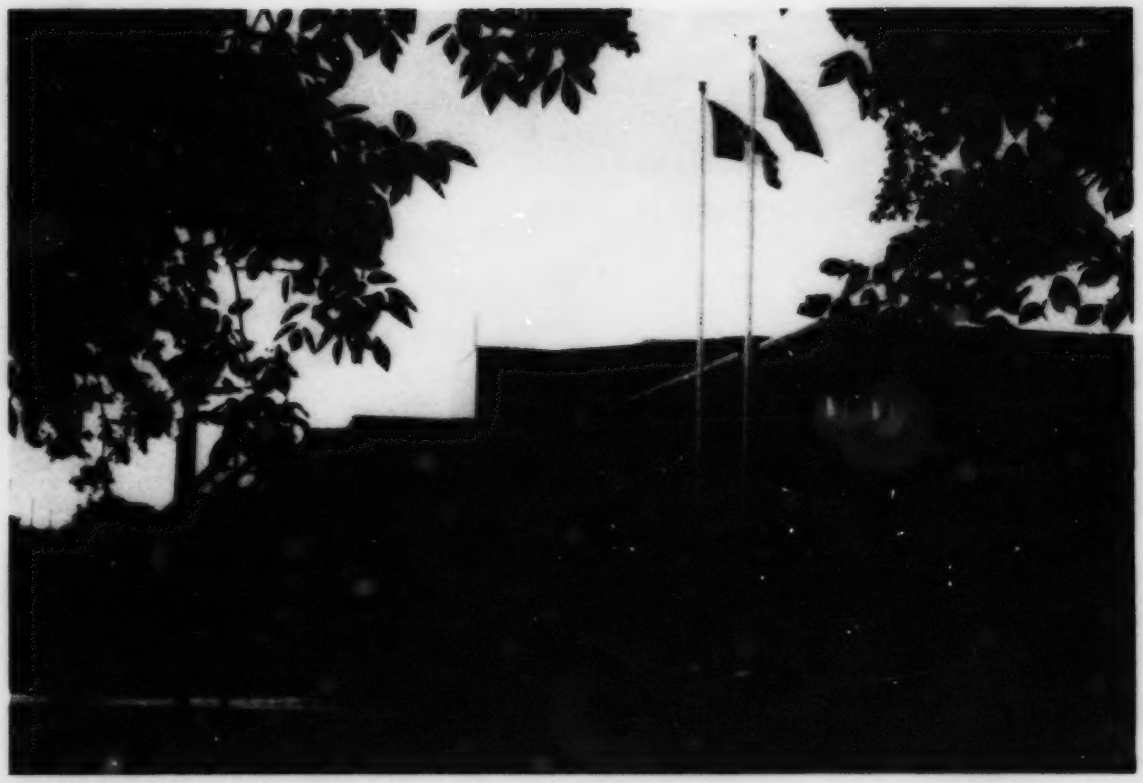

Ontario Ministry of Natural Resources

CHRONOLOGY OF NAMES

1941-1968	Forest Research Section, Research Division, Department of Lands and Forests
1968-1972	Forest Research Section, Research Branch, Department of Lands and Forests
1972-1977	Forest Research Branch, Ministry of Natural Resources
1977-1981	Ontario Forest Research Centre, Ministry of Natural Resources
1981-1989	Ontario Tree Improvement and Forest Biomass Institute, Ministry of Natural Resources
1989-	Ontario Forest Research Institute, Ministry of Natural Resources

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INTRODUCTION

This annotated bibliography covers published research reports, papers and journal articles written or co-authored by staff of the Ontario Forest Research Institute (OFRI) and its predecessors between 1980 and 1991.

Publications are listed alphabetically by first author, under the year of publication. Proceedings of conferences, workshops and symposia are frequently published one or more years after they are held.

Authors' names shown in brackets indicate associates who were not from OFRI or its predecessors at the time the publication was written or published.

Copies of individual articles and reports can be obtained without charge from OFRI at the address below.

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ANDERSON, H. W. (1980). Intensive management of hybrid *Populus*. For. Chron. 56(4): 171-173.
(Observations on the Ontario experience with the short rotation concept of hybrid *Populus* management, with special reference to aspen, are presented and discussed.)

ANDERSON, H. W. and L. ZSUFFA. (1980). Hybrid poplar plantation biomass—a potential source of energy in Ontario, Canada. *In* Proc. 16th Session, Int. Poplar Commission, Izmir, Turkey, 4-8 Nov. 1980. 5 p. + charts and graphs.
(Fast growing hybrid poplar clones have shown high biomass production potential in well managed short rotation plantations in Ontario. Hybrid poplar biomass can be considered to be a solar energy transducer and storage system. This article discusses energy conversion systems for biomass.)

(BLUM, B. M.), (R. M. FRANK) and A. G. GORDON. (1980). Red spruce–yellow birch. Type 30. *In* For. Cover Types U.S. & Can., 1980. Soc. Amer. For., Washington, D.C. pp. 21-22.
(Describes and discusses red spruce–yellow birch cover type in northeastern North America.)

BUCHERT, G. P. (1980). Progress in hard pine breeding at Maple. *In* Proc. 17th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed). Gander, Nfld., 27-30 Aug. 1979. Can. For. Serv. pp. 113-117.
(A study is underway to ascertain the type and amount of genetic variation in natural jack pine populations and determine the effectiveness of selecting superior phenotypes from native stands and designated seed collection areas.)

BURGER, D. (1980). Forest site classification and evaluation. Suggestions for curriculum and research. Forestry Faculty, Agric. Univ. Malaysia. Mimeograph: 38 p.
(New outlines and amendments for 14 undergraduate courses (four years) and brief descriptions of 23 problem areas for interdisciplinary research. are presented. Suggestions are made for research administration.)

BURGER, D. (1980). Site selection for black walnut. Your Forests 13(3): 11-13.
(This is a discussion of the effects of soil texture, structure, nutrients and drainage, local climate and rooting depth on quality growth.)

(CALVERT, R. F.) and R. M. RAUTER. (1980). Status of larch improvement. *In* Proc. Tree Improv. Symp., Sault Ste. Marie, Ont., 19-21 Sept. 1979. Can. For. Serv./OMNR, COJFRC 0-P-7. pp. 145-152.
(Cooperative programs of the Ontario Ministry of Natural Resources and the Canadian Forestry Service are reviewed.)

(CARLISLE, A.) and R. M. RAUTER. (1980). The economics of tree improvement in Ontario. *In* Proc. Can. Tree Improv. Symp., Sault Ste. Marie, Ont., 19-21 Sept. 1979. Can. For. Serv./OMNR, COJFRC 0-P-7. pp. 215-229.
(This paper summarizes available information about costs of tree improvement programs. The use of optimization techniques and the cost of tree improvement activities in Ontario are discussed with suggestions for future action.)

FAYLE, D. C. F. (1980). Cine-analysis of an 18-m tall poplar stem. *In* Proc. of the Joint Wkshp of IUFRO Working Parties on Xylem and Shoot Growth Physiology: Control of Shoot Growth in Trees, Fredericton, N.B., July, 1980. p. 34.
(2-cm thick discs were photographed sequentially with a 16-mm movie camera to examine changes in the annual ring and stain boundaries as one travels "through" the stem.)

FAYLE, D. C. F. (1980). Secondary thickening in tree roots and environmental influences. *In* Proc. Environment & Root Behavior, D. N. Sen, (Ed.). Jodhpur, India, 1980. Geobios International. pp. 93-118.
(The effects of the soil environment on the distribution, anatomy and timing of wood formation in root systems are discussed.)

GLERUM, C. (1980). Electrical impedance techniques in physiological studies. N.Z. J. For. Sci. 10(1): 196-207.
(Electrical impedance trends in the spruces are always more distinct than those in the pines. It is inferred that these trends reflect the stage of dormancy and frost hardiness to some degree; but further refinement of the impedance technique is needed.)

GLERUM, C. (1980). Food sinks and food reserves of trees in temperate climates. N.Z. J. For. Sci. 10(1): 176-185.
(Carbohydrates are the most abudant type of food reserve, but lipids are also important. All tissues are important for food reserve storage, although not of equal importance, depending on the tissue's relative volume and physiological state.)

GLERUM, C. and (J.J. BALATINECZ). (1980). Formation and distribution of food reserves during autumn and their subsequent utilization in jack pine. Can. J. Bot. 58(1): 50-54.
(In conifers, all tissue components of the tree such as the needles store food reserves during fall and winter. Starch and sugars are not the only types of carbohydrate reserves; some hemicelluloses should also be included)

GORDON, A. G. (1980). Paper birch–red spruce–balsam fir. Type 35. *In* For. Cover Types U.S. & Can., Soc. Amer. For., Washington, D.C. p. 23.
(Describes and discusses paper birch–red spruce–balsam fir cover type in northeastern North America.)

GORDON, A. G. (1980). Red spruce–sugar maple–beech. Type 31. *In* For. Cover Types U.S. & Can., Soc. Amer. For., Washington, D.C. p. 22.
(Describes and discusses red spruce–sugar maple–beech cover type in northeastern North America.)

GORDON, A. G. (1980). Spruce genetics, Sault Ste. Marie in 1977 and 1978. *In* Proc. 17th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed). Gander, Nfld., 27-30 Aug. 1979. Can. For. Serv. pp. 117-121.
(The forest genetics and tree improvement program in spruce involving inter- and intraspecific hybridization is discussed.)

HO, R. H. (1980). Pollination mechanism and seed production potential in Douglas fir. For. Sci. 26(4): 522-528.

(Based on seed cone development and seed potential analysis, the most favourable period for controlled pollination appeared to be when a seed cone is three-quarters emerged from the bud scales.)

HOOD, J. and (W.J. LIBBY). (1980). A clonal study of intraspecific variability in radiata pine. I. Cold and animal damage. Aust. For. Res. 1980 (10): 9-20.
(An unusual period of cold weather followed by heavy deer browsing and porcupine damage allowed a genetic assessment of the susceptibility to cold and animal damage of young radiata pine in a genetic-architecture experiment in California. Highly significant differences were detected between the three native mainland populations, and also, for cold and porcupine damage among clones from the same stands.)

JACIW, P. and H. C. LARSSON. (1980). Vegetative propagation of black walnut. *In* Proc. 71st Annu. Rep. Northern Nut Growers Assoc., 1980. pp. 70-74.
(Layering sectioned subterranean parts of black walnut resulted variously in callus formation, root regeneration and suckering. A zone of relatively high regeneration potential exists on the tree axis below the soil surface adjacent to the upper lateral root system.)

LARSSON, H. C. (1980). Asian nut pine nursery problems. *In* Proc. 71st Annu. Rep. Northern Nut Growers Assoc., 1980. pp. 77-80.
(Frost heaving, destruction by rodents and nutritional problems are the three major problems affecting the survival of Korean and Siberian nut pines in the nursery.)

LARSSON, H. C. (1980). Tulip-poplar hardiness trials in southern Ontario. For. Chron. 56(5): 233-236.
(Three strains of tulip-poplar (*Liriodendron tulipifera* L.) were planted in 13 plots in the spring of 1973 and in one plot in the spring of 1975 in four of the climatic zones of southern Ontario. The study was designed to evaluate their hardiness north of their natural range in Ontario. Initial results after five growing seasons indicate that tulip-poplar can be safely planted north of its natural range in climatic zone D providing it is planted in woodlot openings where there is protection from early fall frosts.)

LYON, N. F. (1980). Field trip: Fort William and Shebandowan Management Units. *In* Proc. Boreal Mixedwood Symp., Thunder Bay, Ont., 16-18 Sept. 1980. pp. 11-18.
(Detailed account of the field trip showing trials and results.)

MCCLAIN, K. M. (1980). Nursery culture practices affect post-planting performance of white and black spruce. Agron. Abstr. 1980 p. 203.
(Describes effects of nitrogen levels and seedbed density on subsequent growth of white and black spruce.)

MULLIN, R. E. (1980). Comparison of seedling and transplant performance following 15 years' growth. For. Chron. 56(3): 231-232.
(The fifteenth-year remeasurements of a large series of experiments showed that transplants produced 26%-56% more growth (aggregate height) at a cost saving of 11-23%.)

MULLIN, R. E. (1980). Is moss necessary in all nursery stock packaging? For. Chron. 56(3): 109-111.

(Overwinter storage tests of white spruce, white pine and red pine, and spring storage procedures with two containers (Kraft-polyethylene bag and polybin) showed from the field planting that moss was of no benefit in the packaging.)

MULLIN, R. E. (1980). Recent tests of seedlings versus transplants. OMNR For. Res. Note No. 26: 4 p. (OMNR 3140-6)
(Tests starting in 1977 of current different age-classes of seedlings and transplants of white spruce and red pine indicate that the field performance of transplants is considerably better than that of seedlings, and of the same magnitude or greater than in earlier tests.)

MULLIN, R. E. (1980). Water dipping and frozen overwinter storage of red and white pine. USDA For. Serv. Tree Plant. Notes 31(3): 25-28.
(The practice of water dipping of the roots of red and white pine in the fall, before overwinter frozen storage, was found to be damaging.)

MULLIN, R. E. and (J.D. PARKER). (1980). Nursery use of beach detritus. OMNR Nursery Note No. 69: 4 p.
(A potting test of the material obtained from beach cleaning at Wasaga Provincial Park showed that this material could probably be used with some benefit as a nursery soil amendment.)

MULLIN, R. E. and (R.J. REFFLE). (1980). Effects of dates of lifting and planting on success of frozen spring storage at Swastika nursery. OMNR Nursery Note No. 66: 4 p. + tables.
(This report is based on the fifth-year results of a spring frozen storage experiment conducted at Swastika Nursery in 1973 with white spruce (*Picea glauca* (Moench) Voss), black spruce (*Picea mariana* (Mill.) B.S.P.), and jack pine (*Pinus banksiana* Lamb.).)

RAUTER, R. M. (1980). The development of sound genetic material—seed orchards. *In* Proc. Tree Improv. Symp., Sault Ste. Marie, Ont., 19-21 Sept. 1979. Can. For. Serv./OMNR, COJFRC 0-P-7. pp. 82-94.
(Stages of development for seed orchards from initial planning to actual establishment, management, testing and rogueing are described with particular reference to the current status of orchards in Ontario.)

RAUTER, R. M. (1980). Genetic improvement of spruce and larch for Ontario 1977-1978. *In* Proc. 17th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed). Gander, Nfld., 27-30 Aug. 1979. Can. For. Serv. pp. 123-128.
(This paper highlights results from a few of the spruce breeding experiments and identifies some of the changes that have or will be instituted in the program; progress of the larch work to date is also discussed.)

RAUTER, R. M. (1980). Genetic improvement of white spruce. *In* Proc. Can. Tree Improv. Symp., Sault Ste. Marie, Ont., 19-21 Sept. 1979. Can. For. Serv./OMNR, COJFRC 0-P-7. pp. 105-112.
(Highlights of research of both federal and provincial goverments of Petawawa and Maple respectively are summarized.)

RAUTER, R. M. (1980). The role of seed orchards in forest tree improvement. Proc. 17th Meeting Can. Tree Improv. Assoc., Part 2, Tree Improvement in the Boreal Forest: Today and Tomorrow, M. A. K. Khalil, (Ed.). Gander, Nfld., 27-30 Aug. 1979. pp. 26-42.

(A study of the role of seed orchards in tree impovement.)

RAUTER, R. M. (1980). Spruce cutting propagation in Canada. *In* Proc. IUFRO Working Party, S2.03.11 and S2.02.11, Bucharest, Romania, 24 Sept. 1979. 10 p.
(A summary of the factors affecting rooting in Canada.)

RAYMOND, F. (1980). INREG—an interactive computer program for multiple linear regression by least squares. OMNR For. Res. Rep. No. 106: 21 p. (OMNR 5614)
(Grosenbaugh's REX approach to regression appears vastly superior to the stepwise approach for most research and modelling applications but results are voluminous with large numbers of variables. INREG provides many of the REX features for interactive usage via a computer terminal and allows the user to arrive very quickly at the "best" equation as defined by Grosenbaugh.)

(SASTRY, C. B. R.) and H. W. ANDERSON. (1980). Clonal variation in gross heat of combustion of juvenile *Populus* hybrids. Can. J. For. Res. 10(3): 245-249.
(Energy values were analyzed for 2-year-old sprouts of 10 hybrid *Populus* clones of diverse genetic background. Values showed a clonal range of 14%.)

SKEATES, D. A. (1980). Forest tree seed research in Ontario. *In* Proc. 17th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed.). Gander, Nfld., 27-30 Aug. 1979.Can. For. Serv. pp. 129-132.
(This is a summary of projects within three research programs conducted since 1968; variability due to physical seed characteristics, variability due to seed source, and modified stock production systems.)

STROEMPL, G. (1980). Plastic netting to protect trees from animal damage. OMNR For. Res. Note No. 27: 4 p. (OMNR 3140-7)
(Perforated polypropylene netting placed over red oak transplants established in 1978-79-80 was successful against deer, mice and rabbit damage.)

WEINGARTNER, D. H. (1980). The effects of scarification on trembling aspen in northern Ontario. For. Chron. 56(4): 173-175.
(Preliminary assessments of four study areas in northern Ontario indicate that scarification increases sucker density and stocking, if applied before suckering commences, and all scarification results in a reduction in dominant sucker height.)

ZSUFFA, L. (1980). A breeding program for short rotation poplar biomass production in Ontario, Canada. *In* Proc. IUFRO Working Parties on Poplar Breeding and Provenances, Belgium and France, 17-22 Sept. 1979. 12 p.
(Aspects and concerns of a breeding program for diversified poplar management objectives in Ontario, Canada, is described under subtitles including; methodology of breeding, gene-pool resource in native species, interspecific hybrids, and clonal archives and hybridization.)

ZSUFFA, L. (1980). Poplar, white pine, and ornamental tree breeding at Ontario Forest Research Centre, Maple, Ontario, in 1977 and 1978. *In* Proc. 17th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C.W. Yeatman, (Ed.). Gander, Nfld., 27-30 Aug. 1979. Can. For. Serv. pp. 133-138.

(An outline of activities and results.)

ZSUFFA, L. (1980). The program and the activities of Planning Group 'B'—Growth and Production of the Biomass, IEA/FE Program Group 'B'. *In* Proc. 16th Session, Int. Poplar Commission, Izmir, Turkey, 4-8 Nov. 1980. 4 p.
(Describes the organization and summarizes the activities and results.)

ZSUFFA, L. (1980). The role of exotic and hybrid poplars in the poplar improvement program of Canada. *In* Proc. 17th Meeting Can. Tree Improv. Assoc., Part 2, Tree Improvement in the Boreal Forest: Today and Tomorrow, M. A. K. Khalil, (Ed.). Gander, Nfld., 27-30 Aug. 1979. Can. For. Serv. pp. 43-50.
(A review and discussion including an outline of the role of exotic and hybrid poplars in Canada and of interspecific poplar-hybrids.)

ZSUFFA, L. (1980). An update on poplar breeding activities in Canada. *In* Proc. 16th Session, Int. Poplar Commission., Izmir, Turkey, 4-8 Nov. 1980. 5 p. + appendices.
(A concise summary of the breeding and propagation studies.)

ZSUFFA, L. and H. W. ANDERSON. (1980). The potential of poplar plantations. *In* Proc. Int. Symp. For. Sci. & their Contribution to the Development of Trop. Amer., M. Chavarria, (Ed.). San Jose, Costa Rica, 11-17 Oct. 1979. pp. 99-109.
(Hybrid poplar management system in Ontario, biomass yields and qualities, and utilization potential are discussed in relation to research and development experience in Ontario.)

ZSUFFA, L. and H. W. ANDERSON. (1980). A summary of poplar research and development work in Ontario, Canada. *In* Proc. 16th Session, Int. Poplar Commission, Izmir, Turkey, 4-8 Nov. 1980. 10 p.
(This is a concise summary of the history and work of the present programs.)

ZSUFFA, L., D. BOUFFORD and M. LEGGATT. (1980). Update of Canadian activities in poplar biomass production and utilization. ENFOR Project P-139. Can. For. Serv. 62 p.
(An historical review and a summary of present research and management programs, with a bibliography of *Populus* in Canada.)

BURGER, D. (1981). Summary and recommendations. *In* Proc. Boreal Mixedwood Symp., R. D. Whitney and K. M. McClain, (Eds.). Sault Ste. Marie, Ont., 1980. Can. For. Serv./OMNR, COJFRC Symp. Proc. 0-P-9. pp. 273-278.
(Summarizes 24 papers presented at the symposium and refers to a 1979 COJFRC report for 17 recommendations.)

COLOMBO, S. J. (1981). Summary of project on bud development and winter damage for the period of August 1980-July 1981. DREE Project No. 18.
(The research conducted during the past 12 months focused on problems of bud development, frost hardiness and winter damage in jack pine and black spruce container stock at Swastika Nursery and in jack pine and white spruce at Thessalon Nursery.)

FAYLE, D. C. F. (1981). Frost rings formed in 14-m tall red pine. For. Chron. 57(3): 123.
(Frost rings had formed at the start of most annual rings in the two internodes below the current leader until the trees were nearly 14-m tall.)

FAYLE, D. C. F. (1981). Groove formation in the stem of red pine associated with branches. Can. J. For. Res. 11(3): 643-650.
(The occurrence of grooves both above and below the base of branches indicates effects of both xylem- and phloem-transported substances, with the former having a greater effect.)

FAYLE, D. C. F. (1981). Internodal changes in ring width along a red pine stem. Mitteilungen der forstlichen Bundesversuchsanstalt Wein 142(1): 57-66.
(Overall longitudinal changes in the width of the growth layer are a combination of changes within the internodes and at the nodes (branch whorls).)

FAYLE, D. C. F. (1981). What soil grade changes do to tree roots. Buckeye Arborist May-June: 4-6.
(Factors that affect root growth, and the interrelations between the root and shoot systems are discussed to provide an understanding of potential effects of changes in soil grade.)

GORDON, A. G. (1981). Impacts of harvesting on nutrient cycling in the boreal mixedwood forest. *In* Proc. Boreal Mixedwood Symp., R. D. Whitney and K. M. McClain, (Eds.). Sault Ste. Marie, Ont., 1980. Can. For. Serv./OMNR, COJFRC Symp. Proc. 0-P-9. pp. 121-140.
(Biomass, productivity and nutrient cycling are demonstrated for typical boreal mixedwoods and the consequences of full-tree logging and biomass harvesting are considered. The nutrient budgets, while liberal, of average boreal mixedwoods indicate that full-tree logging can probably be sustained. This is more likely if slash is left. Phosphorus, however, may still be limiting.)

GORDON, A. G. (1981). Woodlands data set. *In* Dynamic Properties of Forest Ecosystems, International Biological Program 23, D.E. Reichle (Ed.). Cambridge University Press. pp. 576-579.
(Four data sets are presented covering major divisions (dry, fresh, moist and wet) of a moisture catena for temperate red spruce forest ecosystems in Ontario site region 5. While the principal species is red spruce, the data also includes white and black spruce where they occur with red on dry sites, and black spruce where it occurs with red on wet sites. Other associated species are balsam fir, hemlock, red maple and yellow birch.)

LEECH, R. H. and Y. T. KIM. (1981). Foliar analysis and DRIS as a guide to fertilizer amendments in poplar plantations. For. Chron. 57(1): 17-21.

(The use of foliar analysis in conjunction with the Diagnostic and Recommendation Integrated System (DRIS) of Beaufils is demonstrated in poplar clone D38 to guide fertilizer amendments and monitor subsequent tree growth by use of greenhouse and field standards.)

LEECH, R. H. and Y. T. KIM. (1981). Studies to improve sugar production in sugar maple. Your Forests 14(1): 32-37.
(Nutrition studies begun in 1976 had as their primary objective to test the effects of various combinations of NPK (Nitrogen Phosphorus Potassium) fertilizers on improving the sugar production of sugar maple. NPK fertilizers were applied in the spring of 1976, 1977, 1978 and in 1979 and 1980 a calcium fertilizer was added to the treatment. the results are discussed.)

LOZANO, F. C. and (I. K. MORRISON). (1981). Disruption of hardwood nutrition by sulphur dioxide, nickel and copper air pollution near Sudbury, Canada. J. Environ. Qual. 10(2): 198-204.
(Foliage from each of four hardwood species—white birch (*Betula papyrifera* Marsh.), red oak (*Qurcus rubra* L.), red maple (*Acer rubrum* L.), and trembling aspen (*Populus tremuloides* Michx.)—growing on sites near Sudbury, Ontario, severely and moderately damaged by fumes and dustfall and soil from beneath the trees were sampled and analyzed for various chemical constituents.)

MCCLAIN, K. M. (1981). Definition and distribution of the boreal mixedwood forest in Ontario. *In* Proc. Boreal Mixedwood Symp., R. D. Whitney and K. M. McClain, (Eds.). Sault Ste. Marie, Ont., 1980. Can. For. Serv./OMNR, COJFRC Symp. Proc. 0-P-9. pp. 5-9.
(A definition of the boreal mixedwood forest is presented in terms of species composition and site. Over 50% of Ontario's productive forest land lies within the boreal mixedwood forest, denoting its significance to the forest economy of the province.)

MCCLAIN, K. M. (1981). Effects of continuous planting on black spruce survival and growth: An interim report. OMNR For. Res. Note No. 28: 4 p. (OMNR 3140-8)
(In northern Ontario, land sites are frequently rugged and efforts to fully mechanize tree planting have been slow. Options available to achieve regeneration targets are; artificial seeding, planting over an extended period of time, or planting continuously. This note highlights the 1976 and 1979 growth performance of a plantation established in Thunder Bay, Ontario.)

MULLIN, R. E. (1981). A container and water dipping test for overwinter storage of black spruce. OMNR Nursery Note No. 75: 6 p.
(In this experiment three containers, a waxed cardboard carton, the polybin, and the regular Kraft-polyethylene bag were investigated for the storage of black spruce along with the option of dry packaging or water dipping before packaging.)

MULLIN, R. E. (1981). Effects of size of frozen stored 3+0 pine on field performance. OMNR Nursery Note No. 71: 4 p. + tables.
(This experiment was conducted to examine the suggestion that size, as a reflection of vigor, might be used to sort the stock to obtain greater success of performance after storage.)

MULLIN, R. E. (1981). Response of a white spruce and white pine planting to sulphur and fertilizer tablets. USDA For. Serv. Tree Plant. Notes 32(1): 14-15.
(Ten years after planting, white spruce and white pine showed little or no benefit from acidification with sulphur or from planting 'pills'.)

MULLIN, R. E. (1981). Seedbed density effects on red pine, in the nursery and after outplanting. OMNR Nursery Note No. 72: 3 p. + tables.
(In the experiment report herein, the effects of the differences in seedbed density of red pine, raised as 3+0 planting material, were examined both in the nursery and 10 years after outplanting.)

MULLIN, R. E. (1981). Water dipping and moss packaging for frozen overwinter storage of jack pine. USDA For. Serv. Tree Plant. Notes 32(1): 3-5.
(Water dipping and/or use of sphagnum moss was found unnecessary for frozen overwinter storage of jack pine in Kraft-polyethylene bags.)

MULLIN, R. E. and (R. E. LAUPERT). (1981). Cold and frozen overwinter storage of white pine at St. Williams nursery. OMNR Nursery Note No. 70: 5 p. + tables.
(An experiment begun to examine the effects of cold and frozen overwinter storage of 3+0 white pine produced at St. Williams nursery.)

MULLIN, R. E. and (C. CHRISTL). (1981). Morphological grading of white spruce nursery stock. For. Chron. 57(3): 126-130.
(3+0 seedling stock was found inferior to 2+2 stock in survival and growth: tentative recommendations are given for size of 2+2 stock as minimum 22 cm top length, minimum 4.0 mm stem diameter, minimum 5ml root volume, and top-root ratio range (by volume) of 1.0 to 3.5:1.)

MULLIN, R. E. and R. HUTCHISON. (1981). The Dunemann option for Ontario. OMNR Nursery Note No. 73: 4 p. + tables.
(A description of the Dunemann process and its potential use in nurseries in Ontario.)

PIERPOINT, G. (1981). Site types in the boreal mixedwood forest. *In* Proc. Boreal Mixedwood Symp., R. D. Whitney and K. M. McClain, (Eds.). Sault Ste. Marie, Ont., 1980. Can. For. Serv./OMNR, COJFRC Symp. Proc. 0-P-9. pp. 10-16.
(Soil and vegetation characteristics of three major divisions of the boreal mixedwood forest are described.)

PIERPOINT, G. (1981). Site types in the boreal mixedwood forest. *In* Proc. Boreal Mixedwood Symp., R. D. Whitney and K. M. McClain, (Eds.). Sault Ste. Marie, Ont., 1980. Can. For. Serv./OMNR, COJFRC Symp. Proc. 0-P-9. pp. 10-16.
(Classification of ecosystem types is discussed. A two-dimensional grid based on soil moisture and nutrient regimes is presented to aid in understanding how the boreal ecosystem types relate to each other. Soil and vegetation characteristics of three major divisions of the boreal mixedwood forest are described.)

PIERPOINT, G., J. M. PATERSON, J. G. BOUFFORD and C. GLERUM. (1981). Irregular growth of outplanted red pine. VI. The influence of handling and planting on fifth-year performance. OMNR For. Res. Note No. 29: 4 p. (OMNR 3361-9)
(Handling and planting procedures during field planting operations influenced survival, current height growth and total height, even after five years. Early monitoring of seedling quality as well as survival is possible and useful in assessing planting success.)

RAYMOND, F. (1981). Some factors affecting yields of spruce on loamy parent materials in boreal Ontario. *In* Proc. Boreal Mixedwood Symp., R. D. Whitney and K. M. McClain, (Eds.). Sault Ste. Marie, Ont., 1980. Can. For. Serv./OMNR, COJFRC Symp. Proc. 0-P-9. pp. 83-96.
(Regression equations which include geographic and physiographic variables demonstrate the significance of both in volume estimation. Unbiased small equations lacking geographic variables may estimate volume poorly in different parts of boreal Ontario.)

SKEATES, D. A. (1981). Stock production in Dewa blocks: an end product of seed research. *In* Proc. 1980 Nurserymen's Meeting, Dryden, Ont., June 1980. pp. 147-153.
(The use of pregerminated seed with acclerated transplant and/or container production systems is described. Techniques are outlined for reducing variability in mass production of containerized coniferous stock.)

(WEBB, D. P.), S. J. COLOMBO and C. GLERUM. (1981). Cold hardiness in relation to bud morphogenesis in *Picea glauca* and *P. mariana*. *Abstract in* Proc. XIII Int. Bot. Congr., Sydney, Australia, 21-28 Aug. 1981. p. 326.
(In black and white spruce, bud development and rate of shoot elongation were strongly correlated with cold hardiness, positively and negatively, respectively.)

WEINGARTNER, D. H. (1981). Forest management and research needs in the boreal mixedwood forest of Ontario: a problem analysis summary. *In* Proc. Boreal Mixedwood Symp., Sault Ste. Marie, Ont., 1980. R. D. Whitney and K. M. McClain, (Eds.). Can. For. Serv./OMNR, COJFRC Symp. Proc. 0-P-9. pp. 209-214.
(Forest management and research needs for the boreal mixedwood forest, as expressed by forest managers and researchers, are presented in synoptic form under the following headings: data base needs, harvesting, forest renewal, tending, and protection.)

(WHITNEY, R. D.) and K. M. MCCLAIN. (Eds.). (1981). Definition and distribution of the boreal mixedwood forest in Ontario. Proc. Boreal Mixedwood Symp., Sault Ste. Marie, Ont., 1980. Can. For. Serv./OMNR, COJFRC Symp. Proc. 0-P-9. 278 p. Obtainable from the Great Lakes Forest Research Centre, Canadian Forestry Service, Box 490, Sault Ste. Marie, Ontario, Canada P6A 5M7
(The proceedings, comprised of 25 papers, reviews current management procedures and problems in Ontario's mixedwood forests, with the intent of stimulating interest in, and improvement of, the management of the Boreal Mixedwood Forest.)

(WYNIA, A.) and K. M. MCCLAIN. (1981). How seedbed density can affect nursery stock costs. For. Chron. 57(6): 276-278.
(The benefits of variable seedbed density in the production of seedling stock are discussed in relation to cost. While certain improvements in seedling morphology may be derived from low seedbed densities, higher associated production costs must be ultimately justified by post planting performance.)

ZSUFFA, L. (1981). Ontario's Hybrid Poplar Program—A summary for the Parliamentary Committee on alternative energy and oil substitution. 3 p. + 4 p. fact sheet.
(Several industrially managed plantation systems designed to satisfy the rapidly growing needs for tree biomass are discussed within the topic of alternative energy and oil substitution.)

ZSUFFA, L. (1981). Experiences in breeding *Pinus strobus* L. for resistance to blister rust. *In* Proc. XVII IUFRO World Congr., Japan, 1981. pp. 181-183.
(The results of more than 20 years of work at Maple, Ontario, breeding white pine (*Pinus strobus* L.) for resistance to blister rust, are summarized.)

ZSUFFA, L. (1981). The production of wood for energy. *In* Proc. XVII IUFRO World Congr., Japan, 1981. 11 P.
(A global review of energy plantations projects.)

ZSUFFA, L. (1981). Technical committee on genetic improvement report on activities in 1980/81. *In* Proc. 3rd Annu. Meeting Poplar Council of Can., J. Menetrier and G. Vallee, (Eds.). Sainte-Foy, Quebec, 20-22 Oct. 1981. pp. 159-160.
(A description of the work of the members of the technical committee on genetic improvement.)

ANDERSON, H. W. (1982). Regenerating yellow birch with prescribed fire. *In* Proc. 1982 Convention of the Soc. of Amer. Foresters, Fire Working Group, Cincinnati, Ohio, 19-22 Sept. 1982. pp. 168-172.
(Yellow birch can be economically regenerated using prescribed fire. Experimental fall burning of tolerant hardwood stands, prior to harvesting, resulted in a 90% reduction in hard maple advance growth stocking less than 1.5m high.)

ANDERSON, H. W. and L. ZSUFFA. (1982). Biomass growth and qualities of hybrid poplar. *In* Proc. 2nd Can. Waferboard Symp. FORINTEK, Ottawa, Ont., 1-3 June, 1982. 20 p.
(Draft: Plantation management and clonal selection strategies are reviewed for hybrid poplar as a resource for wood-based industries. Poplar's genetic variability is considered as a basis for selecting superior clones for specified products.)

ANDERSON, H. W. and L. ZSUFFA. (1982). Genetically improved forest biomass energy production. *In* Proc. 4th Bioenergy R & D Seminar, Winnipeg, Man., 29-31 Mar. 1982. National Research Council (ENFOR). pp. 392-394.
(The biomass productivity, quality and energy efficiency of forest tree species for energy production can be genetically improved by breeding and clonal selection.)

BAKER, W. D. (1982). Natural seed storage in serotinous cones of *Pinus banksiana*. *In* Proc. IUFRO Symp. For. Tree Seed Storage, PNFI, Petawawa, Ont., 23-27 Sept. 1980. pp. 81-90.
(Jack pine (*Pinus banksiana* Lamb.) cones were collected by six cone age classes (1, 2, 3-4, 5-6, 7-9, 10+ years from maturity) to determine the effect of natural seed storage on seed yield and viability. The results indicate that both seed yield and germination decreased with increased age of cone.)

BATES, D., (J. M. BELISLE), (B. H. CAMERON), (L. J. EVANS), (R. K. JONES), G. PIERPOINT and (B. VAN DEN BROEK). (1982). Field manual for describing soils. Ont. Institute of Pedology. 38 p. Available from the Univ. of Guelph, Dept. of Land Resource Science, Guelph, ON, Can. N1G 2W1
(A guide, without instruments, to the identification of soil, soil moisture, deposition, and humus classification in the field.)

BUCHERT, G. P., (C. YING) and (T. RUDOLPH). (1982). Hard pines (panel discussion). *In* Proc. 18th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman (Ed.). Duncan, B.C., 18-21 Aug. 1981. pp. 25-26.
(A discussion of jack pine tree selection; tree improvement and genetic gain in lodgepole pine; tree improvement and genetic gain in jack pine and establishment of family tests.)

COLOMBO, S. J. (1982). The shoot growth habit peculiar to second-year pine seedlings. *In* Proc. Can. Containerized Tree Seedling Symp., C. Glerum, C. A. Plexam and J. B. Scarrat, (Eds.). Environ. Can., Can. For. Serv. COJFRC Symp. Proc. 0-P-10. p. 433.
(A description of the second-year shoot growth in jack pine seedlings is provided in which shoot growth is accomplished primarily by the extension of stem internodes below the first-year bud.)

COLOMBO, S. J. (1982). Winter damage to container seedlings: consequences and prevention. *In* Proc. OMNR Nurserymen's Meeting, Thunder Bay, Ont., 7-11 June 1982. pp. 10-24.

(The deleterious effects of winter damage to the quality of black spruce and jack pine container stock are presented, and the use of the Extended Greenhouse Culture hardening regime to reduce levels of damage is outlined.)

COLOMBO, S. J., (D. P. WEBB) and C. GLERUM. (1982). Cold hardiness and bud development under short days in black and white spruce seedlings. *In* Proc. Can. Containerized Tree Seedling Symp., J.B. Scarrat, C. Glerum and C.A. Plexman, (Eds.). Environ. Can., Can. For. Serv. COJFRC Symp. Proc. 0-P-10. pp. 171-176.
(Cold hardiness of first-year seedlings of black and white spruce was increased by exposure to an 8-hr photoperiod at 20°C before moving them outside.)

COLOMBO, S. J., C. GLERUM and (D. P. WEBB). (1982). Bud development in black spruce container stock. OMNR For. Res. Note No. 32: 5 p. (OMNR 3361-2)
(Artificial shading and extended greenhouse culture are suggested as treatments which will promote bud development while allowing cold hardiness to increase before exposure to freezing temperatures.)

FORSLUND, R. (1982). A geometrical tree volume model based on the location of the centre of gravity of the bole. Can. J. For. Res. 12(2): 215-221.
(This study develops a volume prediction equation for aspen by determining the location of average centre of gravity of the bole by using the indirect approach.)

GLERUM, C. (1982). A bud development study on one-year-old container-grown conifer seedlings. *In* Proc. Electron Microscopy Symp., Toronto, Ont., 3 Feb. 1982. Ont. Min. of the Environment. pp. 14-16.
(Bud development in containerized black spruce seedlings was improved by changing the cultural practices. This resulted in reduced overwinter loses, which were high as 50% to less than 1%, and enhances subsequent field performance.)

GLERUM, C. (1982). Frost hardiness and dormancy in conifers. *In* Proc. Northeastern Area Nurserymen's Conf., Truro, N.S., N.S. Dept. Lands & Forests. pp. 37-46.
(Frost hardiness and dormancy of trees are briefly discussed as well as their possible relationship. The importance of these two physiological processes in nursery cultural techniques is pointed out.)

GLERUM, C. and J. M. PATERSON. (1982). Performance of container-grown and bare-root jack pine three years after outplanting on a northern Ontario cutover. *In* Proc. Can. Containerized Tree Seedling Symp., J. B. Scarrat, C. Glerum and C. A. Plexman, (Eds.). Environ. Can., Can. For. Serv. COJFRC Symp. Proc. 0-P-10. p. 438.
(More than three years are required before a final assessment can be made when comparing bare-root and container stock on a specific site.)

GORDON, A. G. (1982). The consequences of full-tree logging and biomass harvesting relative to maintaining forest ecosystem stability. Panel on soil, site and watershed protection. *In* Proc. Ont. Professional For. Assoc. Annu. Meeting, Sault Ste. Marie, Ont., 29 Jan. 1982. pp. 25-31.
(Describes the nutrient cycle, and factors affecting the availability of nutrients for seedling growth. Boreal upland mixedwood sites have much greater resilience than do black spruce stands. How and what is harvested will have substantial effects on subsequent rotation cycles.)

GORDON, A. G. (1982). Genetics and genecology of spruce, Sault Ste. Marie, Ontario, 1979 and 1980. *In* Proc. 18th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed.). Duncan, B.C., 17-20 Aug. 1981. pp. 112-115.
(Outlines the progress in forest genetics and tree improvement in intra- and interspecific hybridization and clonal propagation in spruce.)

GORDON, A. G. (1982). Importance of ecology in spruce breeding. *In* Proc. COJFRC Info. Session for Forest Managers, Kleinburg, Ont., 23-25 Feb. 1982. 2p.
(From several spruce species, there is evidence that important genotype x environment interaction exists for soil type.)

GORDON, A. G. (1982). Spruces (Panel disscussion). *In* Proc. 18th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman (Ed.). Duncan, B.C., 18-21 Aug. 1981. pp. 23-24.
(Accomplishment and work in progress on genetics, genetic improvement and related research on major species of genus *Picea* across Canada were discussed.)

(GUINON, M.), J. HOOD and (W. J. LIBBY). (1982). A clonal study of intraspecific variability in radiata pine. II. Growth and form. Aust. For. Res. 12: 191-201.
(A genetic-architecture experiment in which samples of radiata pine were assessed periodically during their first nine growing seasons.)

(HAAVISTO, V. F.) and A.G. GORDON (1982). Flushing black and white spruce flowers as an aid in predicting cone crops. Can. For. Serv., Environ. Can./OMNR Leaflet. (Cat. No. Fo42-61/1982E). 6 p.
(Identifies and describes periodicity, growth habit and sex of black and white spruce flowers, and provides a simple method of forced flushing for evaluation of potential cone crops, budworm damage, etc.)

HO, R. H. (1982). Haploid plant culture in poplar. *In* Proc. 7th North American Forest Biology Wkshp—Physiology and Genetics of Intensive Culture, B.A. Thieges, (Ed.). University of Kentucky, Lexington, Kentucky. pp. 210-213.
(This study reports the successful induction of haploid plantlets through anther culture in poplar.)

HO, R. H. (1982). Research on seed-cone receptivity, seed production potential, cone induction and haploid plant culture. *In* Proc. 18th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed.). Duncan, B.C., 17-20 Aug. 1981. pp. 116-118.
(Receptivity and cone induction for white and black spruce, and *in vitro* cloning of white spruce and poplar, are explored.)

HOOD, J. (1982). Spruce and larch genetics, Ontario Forest Research Centre, 1979-1980. *In* Proc. 18th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed.). Duncan, B.C., 17-20 Aug. 1981. pp. 119-120.
(Outlines the progress in spruce and larch hybridization, selection and breeding.)

(JEGLUM, J.), (R. ARNUP), (R. K. JONES), G. PIERPOINT and (G. M. WICKWARE). (1982). Forest ecosystem classification in Ontario's Clay Belt: a case study. *In* Proc. Artificial Regeneration of

Conifers in the Upper Great Lakes Region, G. D. Mroz and J. F. Berner, (Eds.). Michigan Technical University, Houghton, Michigan. pp. 111-128.
(This paper presents the rationale, development, progress, and current status of a five-year program (1979-1983) of forest ecosystem classification for forest management in Ontario's Clay Belt. It includes background and problem definition, a review of previous site classification work, the establishment of a working group, definition of purposes, classification units, mapping program, technology transfer, reception by major clients, a comparison of the usefulness of the ecosystem units with other classifications, an assessment of the strengths and weaknesses of the approach, and the future needs of the program.)

(KARMA, S. K.) and D. A. SKEATES. (Chairperson and co-chairperson). (1982). Summary Report, Tech. Session 4: Factors affecting seed storage. *In* Proc. IUFRO Symp. For. Tree Seed Storage, Petawawa, Ont., Sept. 1980. pp. 219-220.
(The importance of the quality of seed at the time of storage as it is affected by handling and processing of fruits, cones and seeds is stressed.)

LARSSON, H. C. (1982). A silvicultural planting key for lowland sites in southern Ontario. OMNR For. Res. Info. Paper No. 103: 35 p. (OMNR 5615-2)
(The silvicultural planting key is an aid for reforesting lowland sites in southern Ontario. Such factors as elevation, pH, plant cover types, drainage, and silvicultural treatments are presented in a dichotomous key.)

(LATIMER, F.) and D. A. SKEATES. (1982). Seed storage in Ontario. *In* Proc. IUFRO Symp. For. Tree Seed Storage, Petawawa, Ont., Sept. 1980. pp. 6-12.
(This paper describes the functions of the Ontario Tree Seed Plant, which supports the provincial reforestation program.)

LOZANO, F. C. and (I. K. MORRISON). (1982). Growth and nutrition of white pine and white spruce seedlings in solutions of various nickel and copper concentrations. Can. J. Environ. Qual. 11(3): 437-441.
(Ways in which nutrient supply is related to growth and foliage concentration was investigated. As part of a larger problem of tree establishment on certain polluted soils, seedlings of white pine (*Pinus strobus* L.) and white spruce (*Picea glauca* (Moench) Voss) were grown from seed over a 20-week period in nutrient solutions of various Ni and/or Cu concentrations in growth chambers.)

MCCLAIN, K. M. (1982). Growth, nutrition and root development of Ontario tubelings, plugs and 3+0 bare-root black spruce. *In* Proc. Containerized Tree Seedling Symp., J. B. Scarratt, C. Glerum and C. A. Plexman, (Eds.). Environ. Can., Can. For. Serv. COJFRC Symp. Proc. 0-P-10. pp. 331-341.
(Young stands were examined and their growth, nutrition and root development were compared. Bare-root stock outperformed the other two stock types.)

MCCLAIN, K. M. (1982). The question of extending the planting season. *In* Proc. OMNR Nurserymen's Meeting, Thunder Bay, Ont., 7-11 June 1982. 13 p.
(Coordinating species in their various stock types at times when they possess high survival and growth potential can provide the foundation for a continuous planting program.)

MCCLAIN, K. M. (1982). Seedbed spacing and nitrogen effects on nursery growth and post planting performance of white and black spruce. *In* Proc. OMNR Nurserymen's Meeting, Thunder Bay, Ont., 7-11 June 1982. pp. 59-72.
(Results emphasize that the cultural needs of stock must be examined on an individual species basis. Some combinations of drill spacing, nitrogen supply and season of lift give better results than others. Implications are reviewed.)

MULLIN, R. E. and (J. S. LUCAS). (1982). Overwinter storage tests of larch and Tamarack. OMNR Nursery Note No. 76: 3 p. + tables.
(This paper presents preliminary conclusions based on four small experiments with European larch (*Larix decidua* Mill.), Japanese larch (*Larix leptolepsis* Gord.) and tamarack (*Larix laricina* Koch.). The three objectives were to determine the effect of date of fall and spring lifting on survival and growth after outplanting, to determine any differences between regular nursery and Dunemann stock, and to test the usefulness of moisture stress as measured by pressure bomb as an index for the stock's readiness for overwinter storage.)

MULLIN, R. E. and (T. R. MYLAND). (1982). Tests of time of lifting, dipping, and overwinter storage at Dryden nursery. OMNR Nursery Note No. 77: 3 p. + tables.
(Two small experiments were started to study the effects of frozen overwinter storage and dipping on white spruce and overwinter storage in two containers of black spruce. The results are reported here in terms of fifth-year survival and height.)

MULLIN, R. E. and C. CHRISTL. (1982). Morphological grading of white pine nursery stock. For. Chron. 58(1): 40-43.
(3+0 seedling stock was inferior to 2+2 stock in survival and growth: tentative recommendations were given for size of 2+2 stock as minimums of 20 cm for top length, 0.40 cm for stem diameter, 12 ml for root volume, and a top-root ratio less than 3.5:1.)

PAPADOPOL, C. S. (1982). Biomass accumulation response of some poplar clones to water supply in mini-rotations. *In* Physiology and Genetics of Intensive Culture, Proc. 7th North American Forest Biology Workshop, Lexington, Kentucky, 1982. pp. 432-433.

PAPADOPOL, C. S. (1982). Some effects of water supply on the accumulation of poplar biomass and energy budget. *In* Proc. 17th Annu. Meeting North Amer. Poplar Council, Rhinelander, Wisconsin, 20-22 July 1982. pp. 84-91.
(Yields of four 8-year-old *Populus* x *euramerica* clones subjected to different water supply regimes are reported. Biomass accumulation was strongly influenced by irrigation.)

(RAUTER, R. M.) and J. HOOD. (1982). Uses for rooted cuttings in tree improvement programs. *In* Proc. 18th Meeting Can. Tree Improvement Assoc., Part 2, Seed Orchards and Strategies for Tree Improvement, D. F. W. Pollard, D. G. W. Edwards, and C. W. Yeatman, (Eds.). Duncan, B.C., 17-20 Aug. 1981. pp. 82-91.
(This paper presents a summary of the uses for rooted cuttings in various phases of a tree improvement program, namely breeding orchards, cutting orchards, production seed orchards, research plantations and production plantations. It also mentions some of the concerns regarding rooted cuttings as well as some of the problems that need solutions.)

SAUL, G. H. and L. ZSUFFA. (1982). Vegetative propagation of alder (*Alnus glutinosa* L.) by rooted cuttings. OMNR For. Res. Note No. 33: 3 p. (OMNR 3361-3)
(Lignified and green cuttings of European alder can be rooted without difficulty under greenhouse conditions.)

(SCARRATT, J. B.), C. GLERUM and (C. A. PLEXMAN). (Eds.). (1982). Proc. 1982 Can. Containerized Tree Seedling Symp., Environ. Can., Can. For. Serv. COJFRC Symp. Proc. O-P-10. 460 p.
(This symposium reviews the production and use of containerized planting stock for northern tree species, and the effectiveness of container planting as a reforestation method.)

SKEATES, D. A. (1982). Cone collection tower. OMNR For. Res. Note No. 30: 4 p. (OMNR 3361-8)
(This note describes a portable cone collection tower for seed collection from the crowns of standing trees in accessible forest areas.)

SKEATES, D. A. (1982). Pregermination: A key to early vigor in artificial silvicultural systems. *In* Proc. Northeastern Nurserymen's Conf., Halifax, N.S., July 1982. pp. 115-126.
(Advantages of pregermination systems are described, along with operational techniques.)

SKEATES, D. A. (1982). Touring the "Land of Opportunity". *In* Proc. IUFRO Symp. For. Tree Seed Storage, Petawawa, Ont., Sept. 1980. pp. 228-235.
(This article describes the tour of the more accessible developing northern Ontario forests, and of the more developed southern Ontario forests, which were conducted for the IUFRO Working Party on Forest Tree Seed Storage.)

SKEATES, D. A., D. E. IRVING and (L. J. FORCIER). (1982). Pilot studies of black spruce germinant transplants in Northern Ontario. OMNR Nursery Note No. 79: 7 p.
(Pilot operations at Swastika indicate that comparable stock can be produced in a northern nursery on an operational scale to meet established standards for outplanting.)

VANBORRENDAM, W. (1982). Spruce gene pool preservation in southern Ontario. *In* Proc. 18th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W Yeatman, (Ed.). Duncan, B.C., 18-21 Aug. 1981. pp. 129-130.
(A description of the survey initiated in 1980 to identify remnant populations of white spruce on southern Ontario.)

VANBORRENDAM, W. and D. A. SKEATES. (1982). White spruce gene pool conservation in southern Ontario. OMNR For. Res. Note No. 31: 4 p. (OMNR 3361-1)
(Recommendations are made to ensure the conservation of promising populations to help improve the productivity of southern Ontario's future forests.)

ZSUFFA, L. (1982). Biomass Production for Energy in Canada. Proc. *In* Int. Poplar Commission—2nd session of the Ad-Hoc Committee on Biomas Production Systems in Salicaceae, FAO, Casale Monferrato, Italy, 6-10 Sept. 1982. FO:CIP:BS/82/2. 5 p.
(This report describes the potential contribution of biomass energy, especially from poplar, to Canada's plans for energy self-sufficiency by 1995.)

ZSUFFA, L. (1982). Breeding of fast growing hardwoods and white pine at Ontario Forest Research Center, Maple, and Forest Genetics and Tree Breeding at the Faculty of Forestry, University of

Toronto. *In* Proc. 18th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed.). Duncan, B.C., 17-20 Aug. 1981. pp. 131-136.
(A summary of the breeding accomplished in the period from 1979 to 1981 at the Ontario Forest Research Centre on poplar, willow, alder, and white pine.)

ZSUFFA, L. and D. J. MORGAN. (1982). The use of *Populus* and *Salix* biomas for energy—a survey of International Poplar Commission countries. *In* Proc. Int. Poplar Commission—2nd session of the Ad-Hoc Committee on Biomas Production Systems in Salicaceae, FAO, Casale Monferrato, Italy, 6-10 Sept. 1982. FO:CIP: BS/82/2. 2 p.
(This report presents the results of a survey of the present and planned sources of energy, and especially the use of *Populus* and *Salix* biomass for energy, in member countries of the International Poplar Commission.)

ANDERSON, H. W. (1983). High speed forestry in Ontario (or, how I learned to stop worrying and love a weed). *In* Proc. G.I.R.M.S., Vol. 14., Department of Geography, Sir Wilfrid Laurier University, July 1983. pp. 43-62.
(Fast-growing hybrid poplars can produce high yields in minimum time. Breeding and clonal development are described, along with efficient cultural techniques such as interplanting, short-rotation, mini-rotation, and mixed plantations. End uses include fibre, food, energy, and chemicals.)

ANDERSON, H. W., M. M. MCLEAN, D. WRAY and (J. C. SCOTT). (1983). Management of tolerant hardwoods in Algonquin Provincial Park. Science and Technology Series, Vol. 7. OMNR. 72 p.
(This manual is intended to provide the managers with information and guides to assist in assessing the tolerant hardwood forest and in predicting how their management will influence future development of the stands.)

ANDERSON, H. W., C. S. PAPADOPOL and L. ZSUFFA. (1983). Wood energy plantations in temperate climates. For. Ecol. Manage. 6(1983): 281-306.
(Biological factors, methods of genetic improvement, and cultural treatments influencing productivity are discussed. Biomass yields, energy contents and ratios, production economics and conversion methods are reviewed.)

ANDERSON, H. W. and L. ZSUFFA. (1983). Hybrid poplar energy plantations in Ontario. *In* Proc. ENERGO '83, Ontario Energy Opportunities in Biomass, Toronto, Ont., 6-9 Mar. 1983. Min. of Energy. pp. 134-135.
(Intensively managed short-rotation plantations of genetically improved fast-growing trees can make significant contributions to energy supplies.)

ANDERSON, H. W., L. ZSUFFA, C. P. CHEN, (D. N. ROY) and (I. AITOSAAR). (1983). Biomass Resources, The Bio-Energy Council. pp. 44-45.
(Poplar farming.)

BECKWITH, A. F., P. ROEBBELEN and (V. G. SMITH). (1983). Red pine plantation growth and yield tables. OMNR For. Res. Rep. No. 108: 70 p. (OMNR 5614-3)
(The main table projects yields of planted red pine five years after various thinning intensities for a range of sites and ages. Other tables include present yield, normal yields of unthinned stands, individual tree volume and site index.)

BUCHERT, G. P. (1983). Winter hardiness assessment in seedlings of pure and hybrid pitch pine. *In* Proc. 28th Northeastern For. Tree Improv. Conf., R.T. Eckert, (Ed.). Univ. of New Hampshire, Durham, N.H., 7-9 July 1982. pp. 94-101.
(Open-pollinated families from 25 stands in 15 geographic areas as well as selected backcross combinations were assessed for winter survival in southern Ontario. Implications for tree breeding are discussed.)

BURGER, D. (1983). Establishment of a forest research institute at Yezin, Burma. Service report DP/BUR/72/004-1/FO. Food and Agriculture Organization of the United Nations and State University of New York. 24 p.
(This report deals with activities performed during a three-month assignment, of which 10 weeks were spent in Burma (29 June to 10 Sept. 1982). The major part of this report deals with the

provision of an outline of a forest site classification system (based on soil-climate-vegetation interrelationships) useful for forest management, more particularly for the selection of sites for teak and for planning erosion control.)

(DANZMANN, R. G.) AND G. BUCHERT. (1983). Isozyme variability in central Ontario jack pine. *In* Proc. 28th Northeastern For. Tree Improv. Conf., R.T. Eckert, (Ed.). Univ. of New Hampshire, Durham, N.H., 7-9 July 1982. pp. 232-248.
(The high level of isozyme variability found within a small geographic area of jack pine was similar to that found in other conifer species sampled over a much wider area, and has implications for operational jack pine breeding programs.)

DRYSDALE, D. P., D. J. MORGAN and L. ZSUFFA. (1983). Energy plantations—the present situation and plans for 1983-1988. *In* Proc. workshop held by IEA Forestry Energy Programme, Short Rotation Forest Biomass—Production Technology and Mechanization, Per Olov Nilsson and L. Zsuffa, (Eds.). Vettre, Norway, 11 Oct. 1982. pp. 3-11.
(This paper presents some conclusions drawn from a survey of countries cooperating in the Forest Energy Program of the International Energy Agency.)

FAYLE, D. C. F. (1983). Differences between stem and root thickening at their junction in red pine. Plant. Soil. 71(1983): 161-166.
(The cyclical changes in thickening between stem and root where they conjoin are brought about more by changes in moisture availability than by other factors.)

FAYLE, D. C. F., D. MACIVER and C. BENTLEY. (1983). Computer graphing of annual ring widths during measurement. For. Chron. 59(6): 291-293.
(Annual ring width data produced by the DIGI-MIC tree ring measurer are transmitted to an Apple II Plus microcomputer for immediate display of the radial growth pattern. Values are stored for further analysis. Computational and graphics programs for PDP 11/23 are being transferred to Apple IIe with graphics on a Hewlett Packard HP7470A plotter.)

GORDON, A. G. (1983). Report on the U.S.- Canadian tour of areas of recent forest deterioration in the northeastern United States (New York, Vermont, New Hampshire). OMNR File Report. 7 p.
(This is a report of a group of Canadian and American researchers and management staff, working on forest environmental impact and related problems, who visited forests of spruce, spruce-fir and associated hardwoods in which stand deterioration was taking place in northern New York, Vermont and New Hampshire.)

GORDON, A. G. (1983). *Batchawana picetum*. *In* Proc. Can. Inst. For. Annu. Meeting, Oct. 1983. 5 p.
(Describes the picetum and the collection.)

GORDON, A. G. (1983). Nutrient cycling dynamics in differing spruce and mixedwood ecosystems in Ontario and the effects of nutrient removals through harvesting. *In* Proc. Resources and Dynamics of the Boreal Zone, R.W. Wein, R.R. Riewe and I.R. Methven, (Eds.). Thunder Bay, Ont., Aug. 1982. Assoc. Can. Universities for Northern Studies. pp. 97-118.
(Nutrient cycling and productivity of black spruce on peat and moist outwash sand are compared with moderate and high productivity boreal mixedwood ecosystems and north temperate spruce ecosystems. The importance of choosing methods for harvesting which conserve nutrients is discussed.)

HO, R. H. (1983). Wood energy plantations: the state of art and the potential of biotechnology in forest tree improvement. IEA/FE Program Group 'B', 1983.2. 30 p.
(A discussion of genetic manipulation that may lead to practical application in forestry, including ovule and embryo culture; *in vitro* pollination; cloning of the forest trees; production of virus-free clones, resistant trees, haploids, triploids, and somatic hybrids; and genetic engineering.)

HO, R. H., Y. RAJ and L. ZSUFFA. (1983). Poplar plants through anther culture. *In* Proc. 28th Northeastern For. Tree Improv. Conf., R.T. Eckert, (Ed.). Univ. of New Hampshire, Durham, N.H., 7-9 July 1982. pp. 294-300.
(Clones of several poplar species and interspecific hybrids were subjected to anther culture for production of haploids. Experiments using different kinds of plant growth regulators and different combinations of cytokinins and auxins are reported.)

JACIW, P. (1983). Selected references on treatment, disposal and application of urban, industrial and agricultural wastes. Proc. 10th Meeting of Program Group 'B'—Biomass Growth and Production. IEA/FE Program Group 'B', Oslo, Norway, 11-14 Oct. 1982. 41 p.

(JONES, R. K.), G. PIERPOINT and (G. M. WICKWARE ET AL.). (1983). Field guide to forest ecosystem classification for the clay belt, site region 3e. OMNR 161 p. (OMNR 9528)
(This guide will help the user to recognize vegetation and soil features in the Clay Belt and to allocate any stand to one of 14 operational groups within the classification. [Additional authors: J.K. Jeglum, R.W. Arnup, and J.M. Bowles])

(JONES, R. K.), G. PIERPOINT, (G. M. WICKWARE) and (J. K. JEGLUM). (1983). A classification and ordination of forest ecosystems in the Great Clay Belt of northwestern Ontario. *In* Proc. Resources and Dynamics of the Boreal Zone, R. W. Wein, R. R. Riewe and I. R. Methven, (Eds.). Thunder Bay, Ont., Aug. 1982. Assoc. Can. Universities for Northern Studies. pp. 83-96.
(A classification integrating 23 vegetation types and 14 soil types was developed using data collected from 250 forest stands throughout the Great Claybelt of northeastern Ontario. A synthesis of vegetation and soil types resulted in the discrimination of 14 'operational groups'. These groups provide a satisfactory framework for future forest management activities as well as further research in the region.)

MORGAN, D. J., (M. NEENAN) and L. ZSUFFA. (Eds.). (1983). Forest biomass energy and its potential, IEA/FE Program Group 'B', 1983:7. 16 p.
(This brochure summarizes the activities of program group B: Biomass Growth and Production Program, in maximizing efficiency in energy production by optimizing the growth of selected species in energy plantations.)

MOSSELER, A. J. and (M. HUBBES). (1983). Erwinia spp. and a new canker disease of hybrid poplars in Ontario. Eur. J. For. Pathol. 13(1983): 261-279.
(An attempt is made to determine the cause of a new canker and dieback disease affecting poplar hybrids growing in Ontario. Two bacterial species (*Erwinia herbicola* and *Erwinia cartovara*) were investigated as possible causal agents of the disease. Both organisms may be potential pathogens of poplar under certain conditions.)

MULLIN, R. E. (1983). A test of the polybin for frozen overwinter storage of red pine. USDA For. Serv. Tree Plant. Notes 34(1): 3-6.

(The polybin was as successful as the regular Kraft-polyethylene bag for frozen overwinter storage of red pine. Dipping of tree roots before packaging was not advisable.)

(NILSSON, P. O.) and L. ZSUFFA. (1983). Energy plantations—The present situation and plans for 1983-88. *In* Proc. IEA Forestry Energy Programme, Louis Zsuffa and Per Olov Nilsson, (Eds.). Vettre, Norway, 11 Oct. 1982. Swedish Univ. of Agric. Sci., Dept. of Operational Efficiency. pp. 3-11.
(A survey of the countries cooperating in the Forestry Energy Program of the International Energy Agency was conducted in order to assess the present stage of development and plan for the next five years in the area of biomass production from energy plantations.)

PAPADOPOL, C. S. (1983). Methods of estimating irrigation water requirements in forest nurseries and mini-rotations. OMNR File Report: 7 p.

PAPADOPOL, C. S. and (C. R. SILVERSIDES). (1983). Stand establishment of fast growing species for energy plantations. *In* Proc. workshop held by IEA Forestry Energy Programme—Short Rotation Forest Biomass—Production Technology and Mechanization, Per Olov Nilsson and L. Zsuffa, (Eds.). Vettre, Norway, 11 Oct. 1982. Swedish Univ. of Agric. Sci., Dept. of Operational Efficiency. pp. 43-58.
(This report describes the role of stand establishment technology in increasing the productivity of energy forests under temperate climatic conditions. Emphasis is placed on inexpensive biological solutions.)

RACEY, G. and (E. RAITANEN). (1983). Seedling development as affected by fibre and straw mulching at Midhurst Nursery. OMNR Nursery Note No. 94: 5 p.
(The use of sawdust, straw and fibre mulches in newly sown seedling beds was examined. Mulches were compared on the basis of seedling germination rate, stem diameter and oven-dry weight of 1+0 red pine, white pine and Norway spruce.)

RACEY, G. and C. GLERUM. (1983). Overwinter storage, root pruning and plant moisture stress in red pine. OMNR File Report: 7 p. + tables & figures.
(Plant moisture stress from red pine transplants, pruned to a 30.5 cm length after a fall storage lift and spring control lift, was monitered before and after storage and again after outplanting and related to outplanting performance.)

RACEY, G., C. GLERUM and R. HUTCHISON. (1983). Cold and frozen overwinter storage of white cedar. OMNR Nursery Note No. 90: 6 p.
(Outplanting tests were conducted following overwinter storage of 2+1 white cedar. Trees were cold- or frozen-stored in Kraft bags before planting, and treatments were compared on the basis of second-year survival and height growth.)

RACEY, G., C. GLERUM and R. HUTCHISON. (1983). Effects of packaging on field performance of fall- and spring-lifted jack pine at Swastika Nursery. OMNR Nursery Note No. 88: 5 p.
(Trials were conducted to assess the effects of storage of 2+0 jack pine in Kraft bags or burlap bales, with or without water dipping, on the survival and growth of the stock after outplanting. Fall-lifted trees were held in frozen overwinter storage; spring-lifted trees were placed in either cold or frozen storage.)

RACEY, G., C. GLERUM and R. HUTCHISON. (1983). The practicality of top-root ratio in nursery stock characterization. For. Chron. 59(5): 240-243.
(Top length, stem diameter, top volume and root volume are all better indicators of nursery stock quality and potential growth performance than top/root ratio.)

RACEY, G. and R. HUTCHISON. (1983). A comparison of some spring holding options for red pine. OMNR Nursery Note No. 95: 5 p.
(Storage treatments of 3+0 red pine were compared on the basis of fifth-year survival and height after planting. Trees were either stored in a shaded area with roots submerged in water, packed in Kraft bags and refrigerated, or heeled-in and kept in full or partial shade.)

RACEY, G. and R. HUTCHISON. (1983). A field test of the snow cache with 2+2 white spruce from Swastika Nursery. OMNR Nursery Note No. 89: 4 p.
(Experiments were conducted to test the effectiveness of the snow cache for overwinter storage of 2+2 white spruce. Overwintered seedlings were outplanted on two dates and analyzed after two years for height growth and survival.)

RACEY, G. and R. HUTCHISON. (1983). Overwinter storage of Scotch pine at St. Williams Nursery. OMNR Nursery Note No. 87: 4 p.
(This report presents the second-year results of outplanted scotch pine after overwinter storage. The effects of storage and two dates of lifting were evaluated on the basis of second-year survival and growth, and are compared to degree-hardening-day accumulation.)

RACEY, G. and R. HUTCHISON. (1983). Overwinter storage of white pine at St. Williams Nursery. OMNR Nursery Note No. 86: 5 p.
(Fourth-year survival and growth of 3+0 white pine held overwinter in either frozen or cold storage is presented. Results of outplanting are discussed and a DHD value for fall lifting and storage is recommended.)

RACEY, G. and R. HUTCHISON. (1983). Root soaking, plant moisture stress and second year field performance of three coniferous species. OMNR Nursery Note No. 91: 7 p.
(The effects of root soaking and frozen overwinter storage on the plant moisture stress, survival and height growth of white spruce (1.5 + 1.5), red pine (3+0), and white pine (3+0) seedlings were examined in terms of second-year height growth and survival following outplanting.)

RACEY, G., R. HUTCHISON and C. GLERUM. (1983). A comparison of kraft bags and polybins for overwinter frozen storage of white spruce. OMNR Nursery Note No. 92: 4 p.
(The effects of various storage procedures for 2+2 white spruce seedlings were compared using fifth-year survival and height growth following outplanting.)

RACEY, G., R. HUTCHISON and C. GLERUM. (1983). A white pine age-class comparison with variations in site and planting methods. OMNR Nursery Note No. 93: 6 p.
(A study was conducted to examine the effect of age-class on the survival and growth of 3+0, 1+2, 2+1 white pine.)

RAJ, Y. (1983). Application of tissue and anther culture methods in *Populus* breeding. *In* Proc. XV Int. Congr. Genet., New Delhi, India, 12-21 Dec. 1983. Oxford and IBH Pub. Ca. New Delhi. p. 424.

(This article discusses the application of tissue culture methods for the production of haploids through anther culture and also micropropagation of different clones in Populus.)

RAJ, Y., R. H. HO and L. ZSUFFA. (1983). *In vitro* propagation of forest trees by tissue culture. *In* Proc. 28th Northeastern For. Tree Improv. Conf., R.T. Eckert, (Ed.). Univ. of New Hampshire, Durham, N.H., 7-9 July 1982. pp. 281-293.
(Many plantlets were produced from the axillary shoots through micropropagation and also regenerated from calli by tissue culture in two poplar species. One plantlet was regenerated from callus which was derived from cotyledon in white spruce.)

SAUL, G. H. and L. ZSUFFA. (1983). The use of small scions and bare-root stock in grafting white pine. OMNR For. Res. Note No. 34: 3 p. (OMNR 3361-4)
(This note describes grafting trials with small scions and bare-root or potted stock. Small scions can be grafted successfully, though survival is lower on bare-root stock.)

STROEMPL, G. (1983). Growth response of basswood and sugar maple to an intermediate cutting. OMNR For. Res. Rep. No. 107: 19 p. (OMNR 5614-2)
(To keep basswood in a mixed stand, interference must come within the first two decades of stand development. Later cuttings only accelerate the natural decline in basswood.)

ZSUFFA, L. (1983). Aspects of short rotation forest farming in Canada. *In* Proc. Status—und Expertenseminar, Bereitstellung und Verwertung von Lignocellulosen—Entwicklunsstand und Perspektiven (Workshop on Preparation/ Production and Utilization of Lignocellulosic Raw Materials—State of Development and Perspectives), Julich, W. Germany, 20-22 Nov. 1983. pp. pp. 101-129.
(This article describes the development and results of programs in short-rotation and mini-rotation approaches using coppicing or cuttings on prime as well as marginal farmland.)

ZSUFFA, L. (1983). Forest biomass energy production for the North. *In* Proc. 34th Alaska Science Conf., Artic Div., Whitehorse, Yukon, 28 Sept. – 1 Oct. 1983. 12 p.
(Northern sites with potential for cultivation and utilization for growing poplars and willows can be used for wood energy production. Experience and planting stock developed in Scandinavia and Canada can be applied to this purpose.)

ZSUFFA, L. (1983). Genetics in intensive silviculture. Weyerhaeuser Lecture, University of Toronto, 17 Nov. 1983. 36 p.
(This lecture presents a fundamental method for increasing forest productivity with the use of better trees. The history, methodology and prospects for forest tree breeding in Ontario are described.)

ZSUFFA, L. (1983). Ontario's hybrid poplar program—A historical perspective. Proc. Sci. Rev. Hybrid Poplar Prog., Toronto, Ont., 19-20 Aug. 1982. 5 p.
(The author describes the hybrid poplar program in Ontario under the following headings: (1) Tree breeding research and application (2) Breeding and poplar culture (3) The beginning of poplar culture in Ontario (4) The development of a cooperative program (5) The role of technology (6) The perspectives of poplar culture.)

ZSUFFA, L. and D. J. MORGAN. (1983). Forest biomass energy production—a five year retrospect of the work of Program Group 'B'. Proc. IEA/FE Program Group 'B', 1983. 69 p.
(This report describes work since April 1978 within the International Energy agency's programme group for biomass growth and production. Results, constraints, and perspectives are given as well as lists of actions, projects, cooperators and reports.)

ANDERSON, H. W., (J. J. BALATINECZ), C. P. CHEN and (D. N. ROY). (1984). Internal biomass characteristics for efficient energy conversion. Proc. Joint Wkshp. IEA/FE Program Groups 'B', 'C', 'D', Upssala, Sweden, 11 June 1984. OMNR. 22 p.
(Internal biomass characteristics essential for efficient energy conversion are outlined for the present scenario of extensively managed, native forests and for a future prospectus of intensively managed, genetically improved forest. Studies of genetic variation and heritability suggest many of these factors can be selectively combined via hybridization. By means of cloning, improved stock with predictable homogenous quality can be produced for use in intensively cultured energy plantations.)

ANDERSON, H. W. and C. P. CHEN. (1984). Poplar farming. *In* International bio-energy directory and handbook—1984, pp. 44-45.
(This is a description of a project to produce food, fibre and chemicals from mini-rotations of hybrid *Populus* and other hardwoods in Ontario. Production rates of raw materials, chemical procedures, assessment of suitability of hardwoods, and heritability of chemical and energy traits are included.)

ANDERSON, H. W. and L. ZSUFFA. (1984). Biomass growth and qualities of hybrid poplar. *In* Proc. 1982 Can. Waferboard Symp., Ottawa, Ont., 1-3 June, 1982. FORINTEK Canada Spec. Publ. SP508E. pp. 197-200.
(Hybrid poplar plantations, managed on sustained yield with short rotations and high productivity, could alleviate supply problems. Plantation management techniques and clonal selection strategies are discussed.)

ANDERSON, H. W. and L. ZSUFFA. (1984). Genetically improved hardwoods as a potential energy source in Ontario. *In* Proc. Energex 84, the Global Energy Forum, Regina, Sask., 14-19 May 1984. pp. 211-214.
(Clones of *Populus* (poplar) and *Salix* (willow) are being developed which adapt to a variety of sites and management systems and show consistently high productivity, characterized by such features as energy content, wood density, tissue composition and chemical components.)

ANDISON, D., P. ROEBBELEN and A. F. BECKWITH. (1984). Initial thinning in a semi-mature white and red pine stand. OMNR For. Res. Note No. 35: 4 p. (OMNR 3361-5)
(In a comparison of three thinning methods, fairly heavy selection thinning produced the greatest volume in large-diameter trees and resulted in the greatest absolute increase in total volume.)

BECKWITH, A. F., P. ROEBBELEN and (V. G. SMITH). (1984). Manual of red pine plantation growth and yield tables. 56 p. (OMNR 5503)
(Abridged, pocket-sized manual for field use containing tables extracted from Forest Research Report No. 108, Red pine plantation growth and yield tables.)

BECKWITH, A. F., P. ROEBBELEN and S. PESSIONE. (1984). Variable-density growth and yield of managed jack pine plantations. *In* Proc. COJFRC Jack Pine Symp., Timmins, Ont., 18-20 Oct. 1983. OMNR. pp. 145-156.
(Permanent sample plots and stem analysis information have been used to compare jack pine (*Pinus banksiana* Lamb.) in plantations and natural stands.)

COLOMBO, S. J. (1984). Acclimatizing and overwintering spruce container stock. *In* Proc. Nurserymen's Meeting, G. Howard Ferguson Forest Station, Kemptville, Ont., 13-17 June 1983. OMNR. pp. 79-81.
(Hardening with Extended Greenhouse Culture should result in seedlings which have good second-year growth potential due to well developed buds, and which are resistant to both fall frosts and winter dessication.)

COLOMBO, S. J. (1984). Shoot morphology of winter-damaged black spruce container seedlings. OMNR For. Res. Note No. 36: 3 p. (OMNR 3361-6)
(Variations in first-season shoot morphology associated with winter damage in a black spruce paperpot seedling crop are analyzed. Taller seedlings with longer lateral shoots sustained more damage. Extended greenhouse culture is recommended as a means of reducing winter damage.)

COLOMBO, S. J., (D. P. WEBB) and C. GLERUM. (1984). Frost hardiness testing: An operational manual for use with Extended Greenhouse Culture. OMNR For. Res. Rep. No. 110: 14 p. (OMNR 3046)
(Procedures and equipment are described for operationally monitoring the frost hardiness of container-grown seedlings. Guidelines are presented for the Extended Greenhouse Culture method of hardening spruce container seedlings.)

COLOMBO, S. J. and (W. A. SMITH). (1984). Delayed bud initiation in black spruce container seedlings due to accidental daylength extension. OMNR For. Res. Note No. 37: 4 p. (OMNR 3085)
(Yard lights near a greenhouse may delay bud initiation, leading to a lack of uniformity in hardening within the greenhouse.)

COLOMBO, S. J. and C. GLERUM. (1984). Winter injury to shoots as it affects root activity in black spruce container seedlings. Can. J. For. Res.14(1): 31-32.
(Reduced levels of root activity were associated with winter injury to shoots of one-year-old black spruce container seedlings.)

COLOMBO, S. J. and K. D. ODLUM. (1984). Bud development in the 1982-83 overwintered black spruce container seedling crop. OMNR For. Res. Note No. 38: 4 p. (OMNR 3140)
(Some factors affecting bud development are discussed. Levels of bud development are documented to provide baseline data for nurserymen to evaluate stock quality.)

GLERUM, C. (1984). Root volume for characterization of nursery stock. OMNR Nursery Note No. 102: 6 p.
(The purpose of this note is to explain the usefulness of the volume displacement technique for root volume determination and compare it to the generally accepted technique of root area index (RAI) as determined with a rhizometer.)

GLERUM, C., G. RACEY and R. E. HUTCHISON. (1984). Effect of extended cold storage after overwinter frozen storage of white pine and white spruce. OMNR Nursery Note No. 105: 5 p.
(The results suggest that white pine can be cold stored successfully for 28 days after overwinter frozen and that white spruce can be stored even longer.)

GORDON, A. G. (1984). Genetics, genecolgy and tree improvement of spruce in 1981-1982, Sault Ste. Marie, Ontario. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members'

Reports, C. W. Yeatman, (Ed.). Toronto, Ont., 22-26 Aug. 1983. Can. For. Serv., Environ. Can. pp. 94-97.
(Subjects covered include interspecific hybridization, crossability and clonal propagation of hybrids.)

HO, R. H. (1984). Production of important hybrids for sexually incompatible species by ovule and embryo culture, and protoplast fusion. *In* Proc. Int. Energy Agency For. Energy Programme Group B—Biomass Growth and Production Meeting, Uppsala, Sweden, June 1984. 18 p.
(This report presents a collection of references to facilitate studies in producing hybrids of compatible species by *in vitro* techniques.)

HO, R. H. (1984). Research on seed-cone receptivity, cone induction and *in vitro* culture. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed.). Toronto, Ont., 22-26 Aug. 1983. Can. For. Serv., Environ. Can. pp. 98-101.
(Pollination studies in black and white spruce are described. Also reported: research on the enhancement of cone production by chemical and mechanical methods, on haploid plant culture, and on *in vitro* propagation.)

HO, R. H. (1984). Seed-cone receptivity and seed production potential in white spruce. Elsevier Science Publishers, Forest Ecol. Manage. No. 9(1984): 161-171.
(The optimal seed cone stage for controlled pollination in white spruce appeared to occur when the seed cones approached the end of receptivity and this coincided with the peak of pollen shedding. Seed cones pollinated at this stage produced the most filled seeds.)

HO, R. H. and L. ZSUFFA. (1984). Biotechnology in breeding for biomass production. *In* Proc. 1st Bioenergy Specialists' Meeting on Biotechnology, S. Hasnain, J. Lampety and M. Moo-Young, (Eds.). Univ. of Waterloo, Waterloo, Ont., 14-17 Oct. 1984. pp. 70-82.
(Conventional tree breeding constraints hinder progress in developing high yield varieties. *In vitro* pollination and fertilization, *in ovulo* embryo culture and embryo rescue, protoplast fusion, dihaploids, tissue culture-induced variants, and genetic manipulation in tree breeding for biomass production are processes discussed in the article that may remove some of the crossing barriers and obstacles in breeding and cloning.)

MCCLAIN, K. M. (1984). Altering seedling physiology to improve reforestation success. *In* Proc. Seedling Physiol. & Reforestation Success, M. L. Brown and G. N. Duryea, (Eds.). pp. 77-114.
(Reforestation success depends largely upon the physiological and morphological preparedness of seedlings to survive and grow after planting. Frost hardiness, mineral nutrition, and carbohydrate reserves are critical elements of seedling physiology. This paper reviews these elements to illustrate how they are affected by nursery cultural practices and, in turn, their impact on field survival and growth.)

ODLUM, K. D. and S. J. COLOMBO. (1984). A comparison of three antitranspirants for reducing water loss in black spruce container seedlings. OMNR Nursery Note No. 110: 3 p.
(Three commercially available antitranspirants, Vapor Gard, Clearspray, and Folicote, were tested at their recommended rates. Vapor Gard holds the greatest promise as an antitranspirant for nursery and field use.)

PAPADOPOL, C. S. (1984). The atmospheric demand for evapotranspiration: a reliable means for irrigation rate calculations. *In* Proc. Nurserymen's Meeting, G. Howard Ferguson Forest Station, Kemptville, Ont., 13-17 June 1983. OMNR. pp. 85-97.
(This paper presents the concept of the atmospheric demand for evapotranspiration and its use in estimating irrigation water requirment, and for operation of water supply systems in the tree nurseries.)

PAPADOPOL, C. S. (1984). An integrated irrigation system for forest nurseries in Ontario. *In* Proc. ASAE Paper 84-2619, pp. 85-97.
(Automated weather stations provide hourly data to an Apple III microcomputer system for daily estimation of irrigation rates based on potential evapotranspiration. Short- and long-term research applications are outlined.)

PAPADOPOL, C. S. (1984). The renovation of waste water combined with intensive silviculture. American Society of Agric. Engineers. ASAE Paper 84-2647: 10 p.
(A system of waste water renovation based on recycling through forest plantations is proposed. The system provides greatly enhanced recycling rates in comparison with effluent disposal over grass, as well as increased environmental acceptability. Several traits of the system and its operation as a whole are analysed.)

PATERSON, J. M. and D. C. F. FAYLE. (1984). Early prediction of plantation performance for red pine. For. Chron. 60(6): 340-344.
(An indication in year one or two of the relative performance at five years of 3+0 red pine plantations can be obtained by supplementing height and survival measurements with a quality assessment based on needle length and growth characteristics of the terminal shoot in the first two years after outplanting.)

RACEY, G., L. BOWDERY and C. GLERUM. (1984). Root volume for characterization of nursery stock. OMNR Nursery Note No. 102: 6 p.
(The purpose of this note is to explain the usefulness of the volume displacement technique for root volume determination and compare it to the generally accepted technique of root area index (RAI) as determined with a rhizometer.)

RACEY, G. and R. HUTCHISON. (1984). A field test of 3 red pine age classes. OMNR Nursery Note No. 106: 5 p.
(This report compares the performance of 3+0 red pine with 2+0 and 1+2 stock under low competition conditions.)

RACEY, G., R. HUTCHISON and C. GLERUM. (1984). Effect of extended cold storage after overwinter storage of white pine and white spruce. OMNR Nursery Note No. 105: 5 p.
(The purpose of this trial was to determine how long white pine and white spruce could be held in storage after thawing without a reduction in vigor as measured by survival and height growth after outplanting.)

RACEY, J. E. (1984). Effects of root soaking on bare root nursery stock prior to planting. Prepared for OMNR under an agreement with Lakehead University, Thunder Bay. 18 p. + tables & graphs.
(The operational root soaking procedure was examined to determine its effectiveness in maintaining planting stock quality.)

ROEBBELEN, P. and (V. G. SMITH). (1984). An investigation of product form. Can. J. For. Res. 14(6): 768-774.
(Product form (P) of a tree has been defined as the product of diameter-outside-bark at midheight above breast height (d) and total height (H)(P = d x H). It is used along with diameter breast height (D) in product form volume equations for estimating individual tree volumes. The optimal location of the upper diameter was found to be 50% of the total height for red pine and white pine and 47% of total height for jack pine and black spruce. Product form is redefined as P = d* x H where d* = diameter-outside-bark at that average relative height on the tree where d* = (2 x V)/(D x H) as determined from a small sample of scaled trees, for each species and H = total height of tree.)

ROLLER, K. (1984). A guide to the identification of poplar clones in Ontario. OMNR. 98 p. (OMNR 5221)
(A simple and precise key for the identification of 32 Ontario-grown poplar clones, using photographs and illustrations to distinguish their characteristics. A practical classification tool for poplar growers.)

SKEATES, D. A. (1984). Ontario forest tree seed research and development 1981-1983. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed.). Toronto, Ont., 22-26 Aug. 1983. pp. 111-114.
(Several research studies are described, leading to intensive forest management systems using improved quality nursery stock. Studies relate to source of seed, yield and quantity, seed production and collection, and seed utilization.)

STROEMPL, G. (1984). Thinning clumps of northern hardwood stump sprouts to produce high quality timber. OMNR For. Res. Info. Paper No. 104: 27 p. (OMNR 3114)
(This paper summarizes types of sprout development and recommends how to thin clumps of sprouts. Photographs of white ash, basswood, white birch, red maple and red oak illustrate practical examples.)

VANBORRENDAM, W. (1984). Identification of remnant white spruce in southern Ontario: a basis for gene conservation. OMNR For. Res. Rep. No. 109: 20 p. (OMNR 3103)
(A survey of natural remnants of white spruce stands in southern Ontario resulted in the identification of fourteen major groups or gene pools. Seed or scion material should be collected from each and clonal archives should be established to ensure the conservation of promising populations.)

(WOOD, J. E.) and S. J. COLOMBO. (1984). A registry of containerized tree seeding research in Ontario: 1982-83. COJFRC Joint Report No. 4: 23 p.
(This registry outlines both formal and informal, long-term and short-term studies related to the production and use of containerized tree seedlings for reforestation. A brief statement of objectives is included for each study.)

ZSUFFA, L. (1984). Breeding fast growing hardwoods and white pines at the Ontario Tree Improvement and Forest Biomass Institute, Maple, Ontario during 1981 to 1983. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman, (Ed.). Toronto, Ont., 22-26 Aug. 1983. pp. 115-118.
(The breeding programs of poplar, balsam poplar and white pine are discussed.)

ZSUFFA, L. (1984). IEA cooperative research in biomass growth and production. *In* Proc. 1st Tech. Consultation of the CNRE—Forestry Biomass for Energy, Garpenberg, Sweden, 25-27 June 1984. 7 p. + appendices.
(Experts from participating countries of IUFRO, FAO and IEA, have been assembled in order to identify and analyse the problem areas, and to unde ake jointly-funded cooperative projects.)

ZSUFFA, L. (1984). Spacing and thinning, with particular reference to the production of biomass for energy. *In* Proc. IUFRO Planning Wkshp. for Asia on Res. & Tech. Transfer, Kandy, Sri Lanka, 16-24 July 1984. 23 p.
(The importance of wood-based energy is outlined. Multi-purpose species and types of plantings for fuelwood and other uses are exemplified and described. Spacing and thinning are related to tree species and planting types.)

ZSUFFA, L. and D. J. MORGAN. (1984). *Populus* and *Salix* biomass for energy: a survey of International Poplar Commission countries. Unasylva 36 (1984/3): 31-33.
(A survey of present use and future plans in Australia, Canada, France, Hungary, and India.)

ZSUFFA, L., A. J. MOSSELER and Y. RAJ. (1984.). Prospects for interspecific hybridization in willow for biomass production. *In* Ecology and Management of Forest Biomass Production Systems, K. Perttu (Ed.). Dept. Ecol. & Envir. Res., Swed. Univ. Agric. Sci., Report 15. pp. 261-281.
(This article discusses some of the biological features of the genus *Salix* relating to breeding for increased annual yields of biomass for energy purposes.)

1985

BURGER, D. (1985). Ontario site regions in the service of management. *In* Proc. COJFRC Info. Session, Geneva Park, Orillia, Ont., Feb. 1985. 10 p.
(Since managers are working with interrelationships among vegetation, soil and climate in our forest ecosystems, it would be useful to have a classification scheme which outlines similarities and differences among ecosystems. It would be all the more useful if such a scheme would be based on the dynamics of cause-effect relationships because such improved understanding could lead to more effective operations. The system would allow managers to transfer knowledge gained in one area for application in another. Ontario has developed such a system.)

COLOMBO, S. J. (1985). Improving the quality of overwintered container stock using Extended Greenhouse Culture. *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. pp. 28-35.
(Keeping seedlings in the greenhouse until high levels of frost hardiness have been achieved can reduce levels of winter damage from 20% to less than 1%. Increased bud development results in improved plantation performance after out-planting.)

COLOMBO, S. J. (1985). Interpreting the significance of plant moisture stress by means of the pressure-volume technique. *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. pp. 58-65.
(Preliminary trials suggest that nursery stock may be able to tolerate moisture stress which exceeds the wilting point by five to 10 bars. Measurements should be done at the time nursery stock is shipped.)

COLOMBO, S. J., K. D. ODLUM and C. GLERUM. (1985). The use of the pressure bomb for assessing the quality of tree seedlings. *In* Proc. Wkshp on Evapotranspiration, Irrigation and Plant Moisture Stress in Agriculture and Forestry, D. C. McIver and R. B. Street, (Eds.). Kortright Centre for Conservation, Kleinburg, Ont., 2 Oct. 1984. pp. 66-72.
(The pressure bomb holds promise as a tool for nursery and forest managers to evaluate nursery stock with respect to moisture stress.)

GLERUM, C. (1985). Frost hardiness of coniferous seedlings principles and applications. *In* Proc. Wkshp. on Evaluating Seed Quality: Principles, Procedure, and Predictive Abilities of Major Tests, M. L. Duryea, (Ed.). Forest Research Laboratory, Oregon State University, Corvallis, Oregon, 16-18 Oct. 1984. pp. 107-123.
(The external factors that influence frost hardiness such as temperature, light, moisture and nutrients are examined as well as the internal biochemical changes that are associated with hardiness. The various methods for testing frost hardiness are examined and this is discussed in enough detail to serve as a guideline for frost hardiness testing.)

GLERUM, C. (1985). Root pruning at the time of lifting. Panel discussion. *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. p. 55.
(Disadvantages of this common nursery practice are outlined.)

GLERUM, C. (1985). Stock production research program—overview. *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. pp. 26-27.
(Current research and future directions are outlined. Topics include: measuring planting stock quality, stock type testing, improving nursery stock and cultural techniques.)

GLERUM, C. and J. M. PATERSON. (1985). A comparison between red pine seedlings and transplants five years after outplanting. OMNR For. Res. Note No. 39: 4 p. (OMNR 3361)
(The 1+2 stock type appears to be a viable alternative to the 2+2 stock type, because it is cheaper to grow, is more compact, and is easier to handle and plant, while it still performs well.)

GORDON, A. G. (1985). "Budworm! What about the forest?" *In* Proc. Region VI Tech. Conf., Spruce–Fir Management and Spruce Budworm, D. Schmitt (Ed.). Burlington, VT, 1984. Soc. of Amer. For. pp. 3-29.
(Stand structure and dynamics of white spruce-fir and red spruce-fir forests are related to budworm activity. The argument is presented that where spruce and fir grow together, budworm is an essential factor in maintaining spruce in the stand through time.)

HO, R. H. (1985). Effect of repeated pollination upon filled seed in white spruce. Can. J. For. Res. 15(6): 1195-1197.
(Repeated pollination with brush had very little effect on the production of filled seed and pollen from the first pollination was most likely to accomplish fertilization in white spruce. Based on the filled seed and the number of coloured pollen on the nucleus, it was suggested that pollinated ovules would stop exuding any pollination drops.)

HO, R. H. (1985). Production of haploid plants from poplar anther culture. *In* Proc. IUFRO Project Group P1.09.00—Forest Energy and the Fuelwood Crisis, Uppsala, Sweden, 8-9 Sept. 1984. pp. 79-80.
(Production of isogenic pure lines from haploids will enable the breeders to bypass many generations of inbreeding or selfing in order to obtain homozygous lines. The potential of the pure lines can then be fully evaluated through subsequent hybridization and recurrent selection.)

HO, R. H. and Y. RAJ. (1985). Haploid plant production through anther culture in poplars. For. Ecol. Manage. 13(1985): 133-142.
(Haploid plantlets were produced from pollen through anther culture in four out of seven poplar species and hybrids. Most calli produced plantlets with the haploid chromosome number of 19 and some regenerated plantlets had chromosome numbers ranging from 11 to 38.)

HOOD, J. (1985). Development of genetic strategies for clonal forestry. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 2, Clonal Forestry: Its Impact on Tree Improvement and Our Future Forests, L. Zsuffa, R. M. Rauter and C. W. Yeatman, (Eds.). Toronto, Ont., 22-26 Aug. 1983. Can. For. Serv. pp. 84-85.
(Population structure and function, selection, mating testing and development are operational aspects whose genetic components need some "fine tuning" to take advantage of possible benefits.)

HOOD, J. (1985). Optimum allocation of effort when information is available from families, genotypes, and ramets. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 2, Clonal Forestry: Its Impact on Tree Improvement and Our Future Forests, L. Zsuffa, R. M. Rauter and C. W. Yeatman, (Eds.). Toronto, Ont., 22-26 Aug. 1983. Can. For. Serv. pp. 219-220.
(Simple gain formulas for selection among and within full-sib families were modified to include the effect of clonal replication on forward selection of GCA. For GCA forward selection, the range was one to six ramets, and the most frequent optimum, considering all parameters, was two ramets.)

KIM, Y. T. and R. H. LEECH. (1985). Effects of climatic conditions on sap flow in sugar maple. For. Chron. 61(4): 303-307.
(Temperature was the most important climatic factor influencing the amount of sap flow, but rain one day before the collection of sap reduced it. Measurements were taken over a five-year period.)

MAURER, N. L., G. RACEY and R. HUTCHISON. (1985). The Dunemann Option: Small scale production of tree seedlings. OMNR For. Res. Rep. No. 113: 16 p. (OMNR 3530)
(The Dunemann method of seedling production uses forest tree litter as a growing medium instead of mineral soil. Trials to determine the value of the procedure as an alternative to conventional nursery or greenhouse production were conducted at the Midhurst Research Station with red pine, white pine, and white and Norway spruce.)

MORRIS, D. M. and (R. E. FARMER JR.). (1985). Species interactions in seedling populations of *Populus tremuloides* and *Populus balsamifera*: effects of density and species ratios. Can. J. For. Res. 15(3): 593-595.
(A deWit replacement series was combined with a Nelder's design to study the interaction of trembling aspen (*Populus tremuloides* Michx.) and balsam poplar (*Populus balsamifera* L.) seedlings growing at seven relatively high densities for nine weeks after germination. Aspen dominated in all mixes and at all densities.)

(NILSSON, P. O.), R. L. GAMBLES, (C. P. MITCHELL), (D. STEVENS) and L. ZSUFFA. (1985). Programme group activities—Present status, collaboration and future directions. *In* Proc. Joint Workshop of IEA/FE Programme Groups—Biomass Characteristics for Efficient Energy Conversion, Uppsala, Sweden, 11 June 1984. 14 p. + annexes.
(The International Energy Agency's Forestry Energy Agreement is described and its programme functions and responsibilities are outlined.)

ODLUM, K. D. and S. J. COLOMBO. (1985). Testing antitranspirants for nursery use. *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. pp. 153-158.
(Laboratory testing of six antitranspirants to distinguish which are most effective and to ensure that no damaging side effects occur.)

PATERSON, J. M. (1985). Culling practices. *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. pp. 66-68.
(Systematic sampling of culled stock can help nursery growers identify cultural problems and thereby reduce cull and improve stock.)

PATERSON, J. M. (1985). Multiple leadering—Is it a field problem? *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. pp. 48-54.
(Early indications are that multiple-stemmed trees survive and grow as well or better than single-leadered trees, with changes in leader dominance appearing by the end of the first year.)

PATERSON, J. M. (1985). Red pine plantation establishment. *In* Proc. Northwestern Region Silvi. Info., Kenora, Ont., 17-19 Mar. 1985. 3 p.
(Planting stock quality prior to and during the planting operation plus good planting, site conditions and subsequent climatic conditions will all have a bearing on plantation establishment.)

(PELKONEN, P.) and C. GLERUM. (1985). Poplar clonal variation in frost hardiness and electrical impedance during the Fall. OMNR For. Res. Rep. No. 112: 12 p. (OMNR 3454)
(Trials to determine the usefulness of electrical impedance in concert with freezing tests suggest that impedance is not yet suitable for routine measurements of frost hardiness without the accompanying freezing tests.)

RACEY, G. (1985). A comparison of planting stock characterization with root area index, volume and dry weight. For. Chron. 61(2): 64-70.
(Volume, area and weight methods for characterizing tops and roots of coniferous nursery stock were compared for accuracy, reproducibility and practicality using 60 seedling samples of white pine and red pine.)

RACEY, G. (1985). Dissolved oxygen depletion by the roots of conifer seedlings during root soaking. OMNR For. Res. Note No. 41: 4 p. (OMNR 3414)
(Root soaking of more than eight hours duration is not recommended, as prolonged soaking depletes oxygen without improving seedling quality or field performance.)

RACEY, G. (1985). Readiness for overwinter storage. *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. pp. 36-47.
(This is an interim report designed to compare the ability of the Degree Hardening Days (DHD), Electrical Impedance (EI), and Oscilloscope—Square Wave (OSW) methods to determine whether or not coniferous nursery stock is ready for lifting for overwinter storage. The EI and OSW methods appear to be more promising.)

RACEY, G. (1985). Root volume or root area index? *In* Proc. Nurserymen's Meeting, Swastika Forest Station, Swastika, Ont., 18-21 June 1984. OMNR. pp. 69-71.
(This report examines the use of root volume measurements as an alternative to root index (RAI) for the characterization of nursery stock.)

RACEY, G. and (E. RAITANEN). (1985). The effects of fibramulch application rates on conifer seedbeds. OMNR Nursery Note No. 114: 4 p.
(This note reports the findings of a trial in which various application rates of Fibramulch were examined for effects on seedbed density and first-year growth of white pine and white spruce seedlings.)

RACEY, G., C. GLERUM and R. HUTCHISON. (1985). Lifting and overwinter storage of white pine in southern Ontario. For. Chron. 61(6): 480-483.
(Two consecutive studies on 3+0 white pine to determine the degree hardening day (DHD) requirement for lifting and the effect of different storage temperature regimes.)

RACEY, G., R. HUTCHISON and C. GLERUM. (1985). Performance of black spruce accelerated transplants after five years. OMNR For. Res. Note No. 40: 4 p. (OMNR 3366)
(With the accelerated transplant technique, high quality shipping stock can be produced in two years instead of three. ATPs performed well when compared to conventional planting stock.)

RAJORA, O. P. and L. ZSUFFA. (1985). On genetic improvement of trees for social forestry in India. *In* Proc. IUFRO Project Group P1.09.00, Integrated Energy Research—Perspective and Problems Symp., Uppsala, Sweden, 8-9 June 1984. 15 p.

(Basic information is provided for planning tree improvement programs for social forestry in India.)

(SHAW, D. V.) and J. HOOD. (1985). Maximizing gain per effort by using clonal replicates in genetic tests. Theor. Appl. Genet. 71: 392-399.
(Models for predicting cumulative genetic gain from recurrent selection applicable to predominantly outcrossing plant species are discussed with special reference to forest trees. Factors that affect the distribution of variance amoung sources that affect individual selection intensity are the primary determinants of the optimum distribution of effort. Using clonal replicates in genetic tests usually results in increased cummulative genetic gain.)

(SHAW, D. V.) and J. HOOD. (1985). Optimum allocation of effort when information is available from families, genotypes, and ramets. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 2, Clonal Forestry: Its Impact on Tree Improvement and Our Future Forests, L. Zsuffa, R. M. Rauter and C. W. Yeatman, (Eds.). Toronto, Ont., 22-26 Aug. 1983. Can. For. Serv. pp. 219-220.
(The optimum allocation for a fixed population size depends on the proportion of families and numbers of individuals saved, on the heritability, and on the ratio of additive to dominance variance.)

SKEATES, D. A. (1985). Improved seed efficiency through high density accelerated production of coniferous transplants. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 2, Clonal Forestry: Its Impact on Tree Improvement and Our Future Forests, L. Zsuffa, R. M. Rauter and C. W. Yeatman, (Eds.). Toronto, Ont., 22-26 Aug. 1983. Can. For. Serv. pp. 207-212.
(Pregrowing or pregermination techniques for greenhouse production systems are discussed. Developments with the cigarette micro-container are described, with potential applications.)

STROEMPL, G. (1985). Grading northern red oak planting stock. USDA For. Serv. Tree Plant. Notes 36(1): 15-18.
(A system for morphological grading of red oak nursery stock, based on stem form, buds and roots, is described.)

WEINGARTNER, D. H. and (J. T. BASHAM). (1985). Variations in the growth and defect of aspen (*Populus tremuloides* Michx.) clones in Northern Ontario. OMNR For. Res. Rep. No. 111: 26 p. (OMNR 3360)
(Interclonal variation in trembling aspen was investigated for 10 clones in each of six stands in northern Ontario. Results suggest that genetic influences play a secondary role in the observed phenotypic variation.)

(WHITNEY, R. D.) and G. B. MACDONALD. (1985). Effects of root rot on the growth of balsam fir. Can. J. For. Res. 15(5): 890-895.
(Growth increments were compared on balsam fir trees with varying amounts of decay on the stump (15 cm above ground) that originated from the roots. Stand basal area was more useful than tree age as a stratification variable for revealing the effect of root rot on growth. Growth reductions were the smallest in trees with intermediate surrounding basal areas and in trees on drier or heavier textured soils.)

ZSUFFA, L. (1985). Concepts and experiences in clonal plantations of hardwoods. *In* Proc. 19th Meeting Can. Tree Improv. Assoc., Part 2, Clonal Forestry: Its Impact on Tree Improvement and Our

Future Forests, L. Zsuffa, R. M. Rauter and C. W. Yeatman, (Eds.). Toronto, Ont., 22-26 Aug. 1983. Can. For. Serv. pp. 12-25.
(Clonal silviculture has only evolved in poplars and willows. In this paper therefore, the concepts and experiences in clonal plantations are restricted to these two genera.)

ZSUFFA, L., (R. M. RAUTER) and (C. YEATMAN). (Eds.). (1985). Proc. 19th Meeting Can. Tree Improv. Assoc., Part 2, Clonal Forestry: Its Impact on Tree Improvement and Our Future Forests. Toronto, Ont., 22-26 Aug. 1983. Can. For. Serv. 235 p.
(N.B. Available from the Editor, C.T.I.A./A.C.A.A., Canadian Forestry Service, PNFI, Chalk River, ON, K0J 1J0.)

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BATES, D. and D. L. GILLMEISTER. (1986). Ontario Tree Improvement and Forest Biomass Institute publications: 1980-1985. (An annotated bibliography). OMNR For. Res. Rep. No. 114: 31 p. (OMNR 3573)
(This annotated bibliography covers research reports, papers and journal articles written by staff of the Ontario Tree Improvement and Forest Biomass Institute between 1980 and 1985. Book reviews are not included.)

BUCHERT, G. P. (1986). Forest genetics and tree improvement research at Maple 1983-1985. *In* Proc. 20th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman and T. J. B. Boyle, (Eds.). Quebec City, Quebec, 19-22 Aug. 1985. Can. For. Serv. pp. 109-111.
(A study in the physiological genetics program consisting of wood quality of jack pine and isozyme studies.)

BURGER, D. (1986). Comments on classification of forest soil and ecological forest types. Langxiang Forest Bureau, Heilongjuang, Peoples Republic of China. Consultant's report for CIDA's cooperative "Integrated Intensive Forest Management Project", 13-27 July 1986. Thomson-Reid, Collins. 11 p. + appendices.
(Summary of accomplishments and recommendations re terms of reference.)

COLOMBO, S. J. (1986). Second-year shoot development in black spruce *Picea mariana* (Mill.) B.S.P container seedlings. Can. J. For. Res. 16(1): 68-73.
(The relative contributions to second-year shoot elongation by predetermined versus free growth were analyzed for black spruce seedlings. Seedlings from three hardening regimes, production run, short day, and extended greenhouse, were given various shoot-pruning treatments, from the terminal bud removed to the entire shoot removed except for a lateral shoot at the base. Pruned seedlings were compared with winter-damaged seedlings.)

COLOMBO, S. J. and (R. C. CAMERON). (1986). Assessing readiness of black spruce container seedlings for frozen storage using electrical impedance, oscilloscope square wave and frost hardiness techniques. OMNR For. Res. Note No. 42: 6 p. (OMNR 3702)
(The results for electric impedance and frost hardiness are promising but must be considered as preliminary. Hardening regimes significantly affected the date of the development of frost hardiness. Frozen storage of container stock would add flexibility to the double-crop system of producing containerized tree seedlings.)

GLERUM, C. (1986). Some physiological aspects of plantation establishment. *In* Proc. North Western Region Silvi. Info. Session, Kenora, Ont., 17-19 Mar. 1985. 11 p.
(The tree and soil are a continuum and rapid plantation establishment depends on the fact that this continuum is restored as fast as possible after planting. This paper discusses the role of physiology in growing planting stock of the highest possible quality.)

GORDON, A. G. (1986). Breeding, genetics and genecological studies in spruce for tree improvement in 1983 and 1984, Sault Ste. Marie, Ontario. *In* Proc. 20th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman and T. J. B. Boyle, (Eds.). Quebec City, Quebec, 19-22 Aug. 1985. Can. For. Serv. pp. 112-116.
(The objectives of these studies were: (1) to determine genetic variation in efficiency, growth and nutrition as related to site regions and productivity systems and to investigate genotype x environment interaction; (2) to create long-term genetic banks for gene pool and population

studies, preservation, breeding and selection; (3) through intra and interspecific breeding and assessment of genetic parameters to elucidate the breeding system and structure of the genus *Picea*; (4) to produce, test and select the best hybrids for propagation; and (5) to develop genetic and physiological techniques for breeding juvenile trees.)

HO, R. H. (1986). Cone induction and *In vitro* culture in some forest tree species. *In* Proc. 20th Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, C. W. Yeatman and T. J. B. Boyle, (Eds.). Quebec City, Quebec, 19-22 Aug. 1985. Can. For. Serv. pp. 120-123.
(Gibberellic acid 4/7, girdling, and root pruning are used to enhance cone production in black, white and Norway spruce. Haploid plant induction in poplars and vegetative propagation through explant culture in black and white spruce and jack and white pine are explained.)

HO, R. H. (1986). Cone induction in white and norway spruce. *In* Proc. 20th Meeting Can. Tree Improv. Assoc., Part 2, New Ways in Forest Genetics, F. Caron, A. G. Corriveau and T. J. B. Boyle, (Eds.). Quebec City, Quebec, 19-22 Aug. 1985. pp. 96-102.
(White spruce were sprayed with gibberelin $A_{4/7}$ and the optimal period for spraying was found to be May to July. A significant increase in cone production was found on branches sprayed with 800 mg. per litre of $GA_{4/7}$.)

HO, R. H. (1986). Micropropogation of american elm. *In* Proc. 20th Meeting Can. Tree Improv. Assoc., Part 2, New Ways in Forest Genetics, F. Caron, A. G. Corriveau and T. J. B. Boyle, (Eds.). Quebec City, Quebec, 19-22 Aug. 1985. pp. 78-92.
(Cloning of American elm was carried out by culturing the hypocotyl and epicotyl with two cotyledons from germinants.)

HO, R. H. (1986). Promotion of cone production on white spruce grafts by gibberellin $A_{4/7}$ application. For. Ecol. Manage. 23(1986): 39-46.
(White spruce grafts growing in a seed orchard were sprayed with gibberellin $A_{4/7}$ ($GA_{4/7}$), either at different periods of time during the growing season or in different concentrations, for a three-year period. Results are shown.)

(KELLEHER, M.) and C. S. PAPADOPOL. (1986). Pre-feasibility study on expansion and upgrading of Port Dover sewage treatment plant. *In* Proc. Tech. Transfer Conf. No. 6, Toronto Hilton-Harbour Castle, 11-12 Dec. 1985. p. 32.
(Cost/benefit analysis of sewage disposal by spray irrigation of a hybrid poplar tree farm. Other options reviewed: conventional activated sludge, rotating biological contractors, biological aerated filters, extended aeration. The tree farm is most economical over a 20-year period.)

KIM, Y. T., and R. H. LEECH. (1986). The potential use of DRIS in fertilizing hybrid poplar. Soil Sci. Plant Anal. 17(4): 429-438.
(Beaufils' Diagnosis and Recommendation Integrated System (DRIS) was used to diagnose nutrient balance through foliar analysis on hybrid poplar clone I-45/51. The norms for N, P, K,Ca and Mg were evaluated and tested for increased diameter growth through fertilizer treatments in the field.)

LARSSON, H. C. (1986). Ontario Lowland Trees. OMNR File Report: 39 p.

(The important botanical, site and cultural features are outlined for seven conifer and 21 hardwood tree species which are growing or are capable of growing under management in the swamps, flats, river vallys and shorelines of Ontario.)

MACDONALD, G. B. and R. FORSLUND. (1986). Application of a geometrical volume equation to species with different bole forms. Can. J. For. Res. 16(2): 311-314.
(A volume equation based on the paracone (a geometrical solid midway between a paraboloid and a cone) estimated individual tree volume within 10% of the true volume (at the 95% confidence level) for the five species studied.)

ODLUM, K. D. and S. J. COLOMBO. (1986). Antitranspirants that reduce water loss from black spruce container seedlings. OMNR Nursery Note No. 116: 3 p.
(This note reports the laboratory screening of three new antitranspirants not previously tested on black spruce container seedlings: Plantco Antidesiccant, Cloud Cover, and Dow X2 1337, an experimental product.)

PAPADOPOL, C. S. (1986). Growth and yield model for poplar energy cultures. *In* Proc. 9th North American Forest Biology Workshop, C. G. Tauer and T. C. Hennessey, (Eds.). Oklahoma, 1986. 15-18 June 1986. pp. 111-122.
(A model of growth and yield that is simple in conception and operation has been derived by combining the classic approach of de Wit with information about phenology and daily variation of local weather elements.)

PAPADOPOL, C. S. and (J. D. NOLAN). (1986). The potential of tree plantation technology in the land treatment of wastewater from food processing industry. *In* Proc. 5th Int. Symp. Agric. Waste, Chicago, IL, 16-17 Dec. 1985. pp. 411-417.
(The use of a poplar plantation as a final link in the treatment of high-strength effluent offers low energy expenditures, ecological soundness, and landscape aesthetics. Directions are suggested for more research.)

PATERSON, J. M. (1986). A comparison between red pine seedlings and transplants five years after outplanting. *In* Proc. Nurserymen's Meeting, Orono Forest Station, Orono, Ont., 24-27 June 1985. OMNR. pp. 87-89.
(The 1+2 stock type appears to be a viable alternative to the 2+2 stock type, because it is cheaper to grow, is more compact, and is easier to handle and plant, while it still performs well.)

PATERSON, J. M. (Contributor). (1986). Managing red pine plantations. OMNR. 134 p.
(Early red pine plantations, some of which have now reached age 65, are important wood producers and provide considerable environmental and wildlife habitat values. A major objective of these plantations is the production of poles and sawlogs, with secondary products acheived during thinning. Further objectives are to improve recreational and aesthetic values, and to provide wildlife habitat and environmental protection.)

RACEY, G. (1986). A new look at seedbed mulching. *In* Proc. Nurserymen's Meeting, Orono Forest Station, Orono, Ont., 24-27 June 1985. OMNR. pp. 32-37.
(Mulching for seed bed stabilization has been the dominant function at Ontario nurseries, with temperature regulation being a secondary objective with some species. Different mulching trials are discussed.)

RACEY, G. (1986). Red pine stock-type testing program. *In* Proc. Nurserymen's Meeting, Orono Forest Station, Orono, Ont., 24-27 June 1985. OMNR. pp. 84-85.
(When cultural practices are significantly changed, a new stock type is produced. In 1985 a program of stock-type testing was initiated which evaluates relative stock type performance on a wide variety of sites. Success of various stock types will be evaluated on the basis of survival, net height growth, relative height growth, and length of time required for plantation establishment.)

RACEY, G. and (R. CAMERON). (1986). Frozen storage of black spruce cuttings. OMNR Nursery Note No. 117: 5 p.
(The purpose of this trial was to determine if and under what circumstances, frozen (-3°C) black spruce cuttings would root as well as freshly excised cuttings.)

RAJ, Y. and R. H. HO. (1986). *In vitro* propagation of some conifers by cotyledon and epicotyl culture. *In* Proc. 20th Meeting Can. Tree Improv. Assoc., Part 2, New Ways in Forest Genetics, F. Caron, A.G. Corriveau and T. J. B. Boyle, (Eds.). Quebec City, Quebec, 19-22 Aug. 1985. pp. 68-75.
(Plantlets were regenerated from segments of cotyledons, hypocotyls, and the epicotyl with cotyledons in black spruce, white spruce, jack pine, and white pine.)

SKEATES, D. A. (1986). Time of germination: A factor in rate of growth of accelerated transplants of black spruce. USDA For. Serv. Tree Plant. Notes 37(1): 20-24.
(Cotyledonous black spruce (*Picea mariana* (Mill.) B.S.P.) seedlings, initiated in "cigarette" germination plugs, were planted in peat cubes over a range of dates in the greenhouse. Following midsummer transplanting, bare-root trees were sampled in the fall of each production year. Rates of growth were analysed.)

STROEMPL, G. (1986). Conditions of red oak nursery stock as related to outplanting. *In* Proc. Nurserymen's Meeting, Orono Forest Station, Orono, Ont., 24-27 June 1985. OMNR. pp. 90-92.
(Regenerating red oak by planting requires a high degree of silvicultural expertise. Discussed are bud dormancy, root system, and quality grading as conditions that must be met to maximize the chances of survival and growth after outplanting.)

ZSUFFA, L. and (B. BARKLEY). (1986). The commercial and practical aspects of short-rotation forestry in temperate regions: A state-of-the-art review. 19 p.
(A review of short-rotation forestry for energy production in different countries shows a variety of approaches and stages of development.)

1987

ANDERSON, H. W., J. RICE, K. ROBERTS and W. BEEKERS. (1987). Maintaining a yellow birch component using group selection. *In* Managing Northern Hardwoods, R. D. Nyland, (Ed.). Syracuse NY, 1986. p. 423.
(Poster abstract: Seedbed preparation using prescribed fire, and extended canopy reduction by means of group selection during a birch seed year, will usually result in satisfactory stocking and establishment. Subsequent performance in both growth rate and stem quality is related to residual stocking levels and peer competition, which ultimately must be modified to sustain satisfactory growth.)

BURGER, D. (1987). Physiography as an integral part of forest ecosystems. *In* Proc. Natural Environ. Res. Council—The Temperate For. Ecosystem Manage. & Environ. Protection, Yang Hanxi, Wang Zhan, J.N.R.Jeffers and P.A. Ward, (Eds.). Antu, Jillian Province, People's Republic of China, 5-11 July 1986. ITE symposium no.20. pp. 43-48.
(This paper outlines the principles and relevance of a site classification system or model, in which selected physiographic features of soil and climate provide a relatively stable framework for considering the more dynamic vegetation/land relationships both in space and time. Significant characteristics of this system are forest succession in relation to physiography, feature continua, normality rather than average as a reference criterion in such continua, and also the establishment of classes within continua by concurrent reference to vegetation rather than *a priori*.)

COLOMBO, S. J. (1987). Changes in osmotic potential, cell elasticity, and turgor relationships of second-year black spruce container seedlings. Can. J. For. Res. 17(5): 365-369.
(Components of tissue water potential and shoot apical activity of black spruce container seedlings were evaluated during the second-year cycle of shoot elongation. Water potential components estimated using the pressure-volume technique included osmotic potentials at full turgor and the turgor loss point and their difference, relative water content at the turgor loss point, total turgor pressure, maximum bulk modulus of elasticity, and elasticity near full turgor.)

COLOMBO, S. J. (1987). Nursery notes lost and found (An annoted bibliography). OMNR 34 p. (OMNR 3789)
(This report is an annotated bibliography of over 110 OMNR Nursery Notes published from 1963 to 1986.)

COLOMBO, S. J. and D. F. HICKIE. (1987). A one-day test for determining frost hardiness using the electrical conductivity technique. OMNR For. Res. Note No. 45: 4 p. (OMNR 3988)
(This note describes a revision of the three-day test to make it a one-day test. The short test procedure reported here allows test results to be obtained more quickly, permitting seedlings to be moved outside earlier and facilitating the measurement of larger numbers of samples.)

COLOMBO, S. J., K. D. ODLUM and C. GLERUM. (1987). Measuring and improving the physiological quality of planting stock. *In* Stock Production Development Activity Seminar on Stock Standards and Early Plantation Performance, Timmins, Ont., 1-4 Dec. 1986. 13 p.
(This paper presents an overview of a number of the aspects of seedling physiological quality which have been investigated at the Ontario Tree Improvement and Forest Biomass Institute for the past several years. The purpose is to improve plantation performance.)

GILLMEISTER, D. L. and D. BATES. (1987). Ontario Tree Improvement and Forest Biomass Institute: Forest Research 1983-1985. OMNR 89 p. (OMNR 3726)

(Review of selected research activities for the period 1 January 1983 – 31 December 1985 with some reference to 1982.)

GLERUM, C., J. M. PATERSON and G. RACEY. (1987). The development of planting stock standards to ensure plantation establishment. *In* Proc. Stock Production Development Activity Seminar on Stock Standards and Early Plantation Performance, Timmins, Ont., 1-4 Dec. 1986. 10 p.
(Planting stock quality depends on quality seed, proper nursery cultural practices, appropriate lifting, grading, packaging and storage procedures followed by good handling and planting in the field. Standards are required for all nursery and field practices.)

IRVING, D. E., K. GASHOKA and D. A. SKEATES. (1987). Small-scale seed extractory. OMNR For. Res. Note No. 43: 4 p. (OMNR 3702-1)
(To facilitate extraction of seed from cones, a small-scale seed extractory was designed and built at the Ontario Tree Improvement and Forest Biomass Institute, Maple, Ontario. The equipment, used for storing and drying cones and for extracting, dewinging, conditioning, and cleaning of seed, is illustrated and described in this note.)

KIM, Y. T. and C. GLERUM. (1987). Automated ion-exchange column system for biological sample fractionation. Anal. Chem. 59(4): 687-688.
(To avoid the time-consuming work of watching the meniscus in the columns from not getting past the top of the resin, a device was developed that automatically stops the solution flow at the desired level in the column. The construction of this device is described.)

KIM, Y. T., C. GLERUM, J. STODDART and S. J. COLOMBO. (1987). Effect of fertilization on free amino acid concentrations in black spruce and jack pine containerized seedlings. Can. J. For. Res. 17(1): 27-30.
(Fertilization affects both amino acid concentration and frost hardiness. It may be possible to relate amino acid concentration to frost hardiness.)

MCCLAIN, K. M. (1987). The importance of conditioning nursery seedlings to improve field performance. *In* Proc. Stock Production Development Activity Seminar on Stock Standards and Early Plantation Performance, Timmins, Ont., 1-4 Dec. 1986. 30 p.
(Nursery management represents the greatest concentration of technology and investment in the forest growth cycle. This paper identifies important conditioning practices, describes their impact on seedling morphology/physiology and how alterations can enhance seedling performance, and finally, presents the implications of conditioning practices for forest renewal.)

ODLUM, K. D. and S. J. COLOMBO. (1987). The effect of night temperature on bud initiation in black spruce seedlings. *In* Proc. Stock Production Development Activity Seminar on Stock Standards and Early Plantation Performance, Timmins, Ont., 1-4 Dec. 1986. 5 p.
(Overwinter damage to container seedlings results in production losses for the grower as well as in reductions in seedling performance once outplanted. This damage can often be attributed to the failure of seedlings to initiate buds quickly and to subsequently attain acceptable levels of frost hardiness early in the fall, before outside temperatures become extreme. The control of greenhouse temperatures in the production of black spruce (*Picea mariana* (Mill.) B.S.P.) container seedlings may dramatically affect the time required for seedlings to initiate buds.)

ODLUM, K. D. and S. J. COLOMBO. (1987). The effect of three film-forming antitranspirants on moisture stress of outplanted black spruce seedlings. Tree planters' Notes 38(4): 23-26.
(The antitranspirants Cloud Cover, Wilt-pruf NCF, and X2-1337 were applied to black spruce (*Picea mariana* (Mill.) B.S.P.) container seedlings at the time of planting. Wilt-pruf and X2-1337 reduced plant moisture stress (PMS) for up to 14 days but greatly decreased seedling survival. Cloud Cover had no effect on either PMS or seedling mortality. None are recommended for use on outplanted black spruce seedlings.)

PAPADOPOL, C. S. (1987). Comparison of seasonal atmospheric demand for evapotranspiration at six forest nurseries in Ontario. *In* 18th Conference on Agricultural and Forest Meteorology and 8th Conference on Biometeorology and Aerobiology, W. Lafayette, Ind., 14-18 Sept. 1987. Am. Meteor. Soc. pp. 216-219.
(Beginning in 1984 some nurseries were equipped with operational irrigation systems based on the demand of the atmosphere.)

PAPADOPOL, C. S. (1987). Operational model for water requirements of energy cultures. Forest Energy Newsletter 2(8): 10-11.

PAPADOPOL, C. S. and (J. D. NOLAN). (1987). Environmentally acceptable disposal of wastes from vegetable processing industries. *In* Proc. 1987 Food Processing Waste Conf., Atlanta, Georgia, 1-2 Sept. 1987. pp. 14-1 to 14-13.
(This paper provides information about the survival and growth performances of the poplar clones involved in an experiment, as well as some results with respect to renovation efficiency of the system.)

PAPADOPOL, C. S. and L. ZSUFFA. (1987). A simple model for growth and yield for irrigated and rainfed poplar minirotations for fuel. *In* Proc. IUFRO Project Group P1.09.00 'Integrated Research in Biomass for Energy', Fuel Production Strategies, Ljubljana, Yugoslavia, 1986. pp. 59-64.

PATERSON, J. M. (1987). Jack pine planting demonstation area: Garibaldi Township, Gogama District: First-year results. OMNR/OTIFBI. 39 p.
(The outplanting had three objectives: 1. To assess the growth responses of jack pine bare-root and container stock using a combination of planting methods. 2. To provide a demonstration area. 3. To assess the growth responses of fall lifted jack pine, overwintered as frozen stock and outplanted the following spring.)

PATERSON, J. M. (1987.). Red pine needle length in relation to field performance. *In* Proc. Northeastern Area Nursery Wkshp., Wisconsin., 17-20 Aug. 1987. 85-91.
(Nursery needle lengths, which can be influenced by nursery cultural practices, are discussed in relation to survival and height increment after outplanting. Out-planting effects on root, needle and bud development are also discussed showing their relationship to eighth-year field performance.)

RACEY, G. (1987). Cold temperature conditioning of conifer seedlings prior to frozen overwinter storage. OMNR For. Res. Rep. No. 118: 7 p. (OMNR 3573-2)
(This report examines the influences of five dates of fall lifting and five lengths of cold temperature treatments prior to frozen storage on stock survival and height growth after outplanting.)

RACEY, G. (1987). Moisture retaining materials for tree seedling packaging: A literature review. OMNR For. Res. Rep. No. 120: 16 p. (OMNR 5178-1)
(Moisture retaining materials are recommended for frozen storage for private orders, which may be opened and resealed several times during planting, and for seedlings subjected to excessive drying conditions during the lifting or handling process.)

RACEY, G. and R. HUTCHISON. (1987). Tamarack and European larch can be overwinter-stored. For. Chron. 63(3): 179-181.
(Three fall-lifting and overwinter storage trials of tamarack and European larch were conducted in Southern Ontario to determine whether these species were suitable for overwinter storage.)

RACEY, G. and G. R. SANGUINS. (1987). An evaluation of sprayable latex mulches in some forestry applications. OMNR For. Res. Rep. No. 115: 9 p. (OMNR 3573-1)
(The purpose of this research was to evaluate some of the effects of sprayable latex mulches on: i) a plant's growing environment; ii) nursery seedbed stabilization; iii) seed germination rates; and iv) seedling performance after outplanting.)

SKEATES, D. A. and (V. F. HAAVISTO). (1987). Black spruce cone and seed production: Yields from Ontario collections. OMNR For. Res. Rep. No. 119: 16 p. + appendices. (OMNR 5178)
(The intent of this paper is (a) to summarize research results to date on cone and seed production in black spruce, (b) to identify factors influencing cone and seed yields, and (c) to provide additional baseline information to facilitate the forest manager's implementation of meaningful strategies.)

STROEMPL, G. (1987). Growth and quality of red oak planted in a jack pine plantation. OMNR For. Res. Note No. 44: 4 p. (OMNR 3939)
(There are a few successful red oak plantations in southern Ontario forests but only one is known to have been documented. This note illustrates one of several experiments under way in forest districts of the Algonquin and Central regions, of Ontario where red oak is underplanted or interplanted in stands conventionally rated as "exclusive" pine sites.)

STROEMPL, G. (1987). Growth and quality of red oak planted in red pine plantation openings. OMNR For. Res. Rep. No. 117: 6 p. (OMNR 3989)
(One of several planting trials in the forest districts of Algonquin and Central Regions of Ontario is discussed. The purpose of these trials is to test the survival and potential growth of red oak nursery stock that has been planted under a variety of stand conditions. Ninety-eight percent of red oak nursery stock survived following planting in openings of a mature red pine plantation. Of these, 61% produced an average height of 3m in 10 years and exhibited good stem quality.)

STROEMPL, G. (1987). Hardwood silviculture—thinning coppice growth to produce biomass and timber. Silviculture 2(2): 20-22.
(Basic thinning guidelines for hardwood stands of coppice origin are provided for forest practitioners and woodlot managers.)

(BAKER, W. D.) and J. HOOD. (1988). Seed collection, tree improvement and their potential genetic effects. *In* Panel XI, Class Environmental Assessment on Timber Management. pp. 559-600.

BUCHERT, G. P. (1988). Physiological genetics studies. *In* Proc. 21st Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, T. J. B. Boyle, (Ed.). Truro, N.S., 17-21 Aug. 1987. pp. 60-61.
(Four studies were outlined: Growth analysis of Jack Pine container stock, wide testing of selected white pine clones, testing white pine for blister rust resistance and black spruce clonal identification.)

BUCHERT, G. P. (1988). Tapping our Forests. Trees act as a sponge to pollutants that are behind the "Greenhouse Effect". For. Scene, Summer 1988. p. 8.
(Global change in climate and the need for the absorption of carbon dioxide.)

BURGER, D. and (ZHAO SHIDONG). (1988). An introductory comparison of forest ecological conditions in Northeastern China and Ontario Canada. For. Chron. 64(2): 105-115.
(For two fairly similiar areas, the vegetation is compared in relation to broad features of the land. Items include location and land areas, history and forest resources, relief and climate, potential commercial tree species and vegetation regions, bedrock geology, soil parent materials and soil development. Ecological knowledge is considered important for the effective transfer of silvicultural technology and the exchange of plant material between the two areas.)

COLOMBO, S. J. (1988). The pressure bomb as a silvicultural tool. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. p. 105.
(Poster abstract: The ability of nursery stock to survive and grow during drought is determined on the basis of seedling water relations properties, which can be measured with a pressure bomb. The "wilting point" is one water relations property that may indicate a seedlings ability to withstand drought.)

COLOMBO, S. J. and (J. E. WOOD). (1988). Containerized tree seedling research and development in Ontario 1984-1985. COJFRC Joint Report No. 11. 21 p. and appendices.
(This is the second register of this type. Each study reported is annotated with study objectives and the names and affiliations of investigators.)

COLOMBO, S. J. and (R. C. CAMERON). (1988). Air and soil temperatures in container seedling overwintering beds. OMNR Nursery Note No. 119: 8 p.
(This note describes air and soil temperature fluctuations to which container tree seedlings may be exposed under operational conditions after being removed from the greenhouse and discusses some techniques by which temperatures in holding areas can be modified.)

COLOMBO, S. J. and (W. A. SMITH). (1988). Response of containerized black spruce and jack pine seedlings to fertilization rate and growing medium. OMNR For. Res. Rep. No. 116: 15 p. (OMNR 5270)
(This report presents (1) the results of a semi-operational nursery trial of fertilizer concentration and seedling nutrient contents resulting in best seedling growth, and (2) the effect of fertilization on bud development and fall freezing damage.)

COLOMBO, S. J. and G. RACEY. (1988). Overwinter storage of nursery stock. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. pp. 34-38.
(Overwinter frozen storage offers numerous logistical and biological advantages associated with an assured supply of dormant stock for spring planting.)

(FARMER, R. E.), D. M. MORRIS, (K. B. WEAVER) and (K. GARLICK). (1988). Competition effects in juvenile jack pine and aspen as influenced by density and species ratios. J. of Applied Ecology 25: 1023-1032.
(Jack pine and trembling aspen seedlings were grown in a replacement series (100, 75:25, 50:50, 25:75, 100) at variable densities (17 to 10,000 plants per m^{-2}) for 12 weeks in a greenhouse experiment and for three years in a field test. Analysis of survival, height, weight, form, resource allocation, relative yields, and relative crowding coefficients indicated that aspen dominated in all mixtures and densities except at 10,000 plants per m^{-2}.)

(FOWLER, D. P.), (Y. S. PARK) and A. G. GORDON. (1988). Genetic variation of red spruce in the Maritimes. Can. J. For. Res. 18(6): 703-709.
(Red spruce, (*Picea rubens* Sarg.), from 30 provenances was tested over a 23-year period at six locations in the Maritimes Region of Canada. Twenty-eight of the provenances were from the Maritimes Region and two were from West Virginia. Hybrid index was used to distinguish pure red spruce from red-black spruce derivatives. The Maritimes Region can be considered as a single breeding zone for tree improvement efforts with red spruce.)

GILLMEISTER, D. L. (Editor/Writer). (1988). Basic research yields clues *and* Impedance bridge takes the worry out of being close. For. Res. (Newsletter) Fall 1988. OTIBI. 4 p. (OMNR 4169)
(Focus on frost hardiness: Interview with Chris Glerum about safer fall lifting and overwintering.)

GILLMEISTER, D. L. and D. BATES. (1988). Ontario Tree Improvement and Forest Biomass Institute: Forest Research 1987. OMNR 76 p. (OMNR 5250)
(Review of selected research activities for the period 1 January 1987 – 31 December 1987)

GILLMEISTER, D. L. and D. BATES. (1988). Ontario Tree Improvement and Forest Biomass Institute: Forest Research 1986. OMNR 70 p. (OMNR 5250)
(Review of selected research activities for the period 1 January 1980 – 31 December 1986)

GLERUM, C. (1988). Evaluation of planting stock quality. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. pp. 44-49.
(The quality of planting stock is assessed by means of (1) morphological parameters such as height, diameter, oven-dry weight, root area or volume, needle length, and bud size, and (2) physiological parameters such as root growth capacity, nutrient content, water relations, dormancy, frost hardiness, electrical impedance, food reserves and photosynthesis. The applicability of all these parameters is discussed within the framework of the planting stock quality concept that has, as its objective, the optimization of field performance.)

GLERUM, C. (1988). Planting stock quality evaluation. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. p. 106.

(Poster abstract: The quality of planting stock is assessed by means of (1) morphological parameters such as height, diameter, oven-dry weight, root area or volume, needle length, and bud size, and (2) physiological parameters such as root growth capacity, nutrient content, water relations, dormancy, frost hardiness, electrical impedance, food reserves and photosynthesis. The applicability of all these parameters is discussed within the framework of the planting stock quality concept that has, as its objective, the optimization of field performance.)

GORDON, A. G. (1988). Genecological and genetic studies in spruce. *In* Proc. 21st Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, T. J. B. Boyle, (Ed.). Truro, N.S., 17-21 Aug. 1987. pp. 58-60.
(The objectives of these studies are: (1) to investigate genotype x environment interaction with regard to variation in efficiency, growth and nutrition as related to site regions and productivity systems; (2) to create long-term genetic banks for gene pool and population studies, breeding, and assessment of genetic parameters to elucidate the breeding system and structure of the genus *Picea*; (3) to produce, test and select the best hybrids for propagation; and (4) to develop genetic and physiological techniques for breeding juvenile trees.)

GORDON, A. G. (1988). The possibility of aiding the restoration of the rare and endangered spruce species (*Picea mexicana* Martínez). *In* Forest Genetics Working Group Meeting, North American Forestry Commission, Placerville, Calif., 1988.
(*P. mexicana* is a new-to-science relict species discovered only as recently as 1961. It is known from only two adjacent stations in the northern Sierra Madre Oriental mountain range of Mexico. In 1975 the main stand was decimated by fire which burned over 10,000 ha. The second stand is itself only a fragment with a few trees. Our collection of Mexican *Picea* dating back to 1963 now presents a genetic bank which can be used to assist in the restoration of this species through tree improvement methodology. The status of the species is reviewed and the proposed cloning rationale, site and other project requirements are provided. Intra- and interspecific hybridization work with *P. mexicana* are reviewed both in relation to tree improvement and its phylogenetic implications.)

(HAAVISTO, V. F.), (R. L. FLEMING) and D. A. SKEATES. (1988). Potential and actual yields of seed from black spruce cones. For. Chron. 64(1): 32-34.
(Black spruce (*Picea Mariana* (Mill.) B.S.P.) treees have semi-serotinous cones and disperse seed over a period of years. This study showed that actual seed complements within cones are similar to theoretical estimates, ranging from 50 to 110 seeds per cone.)

HO, R. H. (1988). Flower induction and tissue culture studies. *In* Proc. 21st Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, T. J. B. Boyle, (Ed.). Truro, N.S., 17-21 Aug. 1987. pp. 62-63.
(Three studies are outlined: cone induction, anther culture and tissue culture in black spruce and jack pine.)

HO, R. H. and A. Y. RAJ. (1988). *In vitro* culture of explants from mature black spruce. *In* Proc. 21st Meeting Can. Tree Improv. Assoc., Part 2, Tree Improvement—Progressing Together, E. K. Morgenstern and T. J. B. Boyle, (Eds.). Truro, N.S., 17-21 Aug. 1987. pp. 191-192.
(Fifteen black spruce (*Picea mariana* (Mill.) B.S.P.) trees which were growing in the arboreta at Maple, Ontario, in three age classes of 15, 25 and 30 years were sampled. Buds were collected from the lower crown of each tree one day before incubation. Bud scales were removed and the

embryonic shoots were excised above or below the crown. Monthly incubation from Aug. to Feb. was carried out to define the best time for sampling for culture. Different media are discussed.)

KIM, Y. T. and C. GLERUM. (1988). Free amino acid concentrations in red pine needles during three successive autumns. Can. J. For. Res. 18(10): 1286-1290.
(Seasonal free amino acid concentrations in current-year red pine needles were determined weekly or biweekly from September to December over a three-year period.Tryptophan and histidine were the only amino acids that had significant positive trends, while threonine had a significant negative trend.)

KOPPENAAL, R. S. and S. J. COLOMBO. (1988). Increasing heat and frost tolerance in black spruce seedlings by short-day induction of bud initiation. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. p. 106.
(Poster abstract: Heat and frost can have a direct influence on post-planting seedling survival on open boreal sites. Operational testing and laboratory trials indicate that there is an increase in spruce (*Picea* spp.) seedling tolerance to high and low temperatures during the initial stages of bud development.)

MCCLAIN, K. M. (1988). Deciding when and what to plant? Be careful! *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. p. 107.
(Poster abstract: Many silvicultural options, such as choice of species, stock type and time of planting, are available when reforestation project are planned. An attempt to quantify differences in forest tree performance in relation to these factors has yielded results demanding that the questions of when and what to plant be given special consideration.)

MORRIS, D. M. (1988). Evaluation of morphological and physiological response variables of 4-year-old black spruce seedlings to perennial competition. NWOFTDU Tech. Report #23. 15 p.
(The purpose of this paper was to highlight terms used in competition dynamics and evaluate those variables commonly used to describe plantation response to competition. Although foresters commonly use either total height or current height increment as response variables when examining plantation performance, the preliminary results from this study demonstrated that these are not reliable for 4-year-old plantations. The most consistent response variable was the square root of the total seedling dry weight.)

MORRIS, D. M., (M. ROSE) and G. B. MACDONALD. (1988). Stand structure, species composition, and growth of the boreal mixedwood forest in northern Ontario: a comparison of natural stands and plantations. NWOFTDU Tech. Report #22. 21 p.
(The purpose of this paper was to provide awareness about the complexities of the boreal mixedwood forest in northern Ontario. A series of figures compared the changes over time in species composition, stand structure, and growth rate for natural stands and plantations on typical mixedwood sites.)

(O'NEILL, G. J.), (M. DITNER) and G. RACEY. (1988). Undercutting and wrenching of red pine, white pine and white seedlings. OMNR For. Res. Note No. 46: 4 p. (OMNR 4190)

(Reducing seedbed density was as important to morphological modifications as the undercutting and wrenching techniques. Spacing and density must be considered when developing and comparing techniques.)

ODLUM, K. D. and S. J. COLOMBO. (1988). The effect of greenhouse temperatures on bud initiation. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. p. 106.
(Poster abstract: The speed of bud initiation in seedlings of black spruce (*Picea mariana* (Mill.) B.S.P.) grown in the greenhouse can be greatly influenced by night temperatures.)

ODLUM, K. D. and S. J. COLOMBO. (1988). Short day exposure to induce budset prolongs shoot growth in the following year. *In* Proc. Combined Meeting of the Western Forest Nursery Associations, Vernon, B.C., 8-11 Aug. 1988. Gen. Tech. Rep. RM-167. USDA For. Serv. 3 p.
(Short day exposure applied in the greenhouse prior to overwintering container black spruce (*Picea mariana* (Mill.) B.S.P.) seedlings dramatically influenced the timing and duration of shoot growth in the first year after outplanting.)

PATERSON, J. M. (Contributor). (1988). Management information report for the 1987 planting trials. The Stock Production Development Activity. Northern Forest Development Group, OMNR.
(The planting stock trials are the result of a problem analysis involving growers, clients, and researchers at the Dec. 1986 seminar in Timmins on Stock Standards and Early Plantation Performance. First-year results from the 1987 outplantings are presented.)

PATERSON, J. M. and C. GLERUM. (1988). Good planting pays. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. p. 108.
(Poster abstract: Planting quality has a direct effect on survival and growth and will determine future forest management. The physical shock to the seedling at planting is one of the most critical factors in the establishment of a new stand.)

PIERPOINT, G. and P. UHLIG. (1988). A minimum standard for describing forest sites with a soil pit. OMNR. 16 p.
(This guide outlines a minimum tally of important soil/site features and provides an example of a tally sheet that can be used.)

RACEY, G. and S. J. COLOMBO. (1988). Overwintering and frozen storage of container and bare-root nursery stock. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. p. 109.
(Poster abstract: Research results from Ontario show that properly conditioned, lifted, handled and frozen-stored nursery stock will survive and grow the following year as well as stock over-wintered out of doors, and also offers additional benefits.)

RACEY, J. E. and G. RACEY. (1988). Undercutting and root wrenching of tree seedlings: An annotated bibliography. OMNR For. Res. Rep. No. 121: 79 p. (OMNR 5178-2)
(The topic of undercutting and root wrenching is complex and deals with many facets of plant science. This annotated bibliography is an attempt to collate and briefly summarize a large body of literature in a uniform context to increase its availability and usefulness to others.)

RAJ, Y. AND R.H. HO. (1988). *In vitro* culture of embryonic shoots from mature black spruce trees. *In* Proc. 2nd Canadian Plant Tissue Culture and Genetic Engineering Workshop, W. A. Keller, (Ed.). Carleton Univ., Ottawa, Canada, 29 May–2 June 1988. p. 31.
(Poster abstract. Buds from eight black spruce trees, age 25-30 years, were collected a day before incubation. Bud scales were removed and embryonic shoots were dissected. The embryonic shoots were incubated on six different media. No plantlet has yet been produced from rooting of adventitious shoots.)

(RAUTER, R. M.) and J. HOOD. (1988). Quality stock through quality seed: the role of tree improvement. *In* Taking Stock: The Role of Nursery Practice in Forest Renewal, Kirkland Lake, Ont., 14-17 Sept. 1987. OFRC Symposium Proceedings O-P-16. pp. 19-23.
(A good-quality seedling begins with a seed that is in good physiological condition. We can obtain even better-quality trees if the genetic potential of the seed is increased, as is possible through a sound tree improvement program.)

SKEATES, D. A. and D. E. IRVING. (1988). Nursery indications of white spruce provenance variability in northwestern Ontario. OMNR For. Res. Rep. No. 122: 13 p. (OMNR 4176)
(This paper is a preliminary assessment of vigor based on performance of plants from 75 sources after three years of growth in transplant beds in Dryden nursery. On the basis of this assessment, related subjects such as zonation, seed collection, seed distribution, ecotypic variation and implications for management are discussed.)

ANDERSON, H. W. and J. RICE. (1989). Modeling tolerant hardwood stand dynamics to improve silvicultural prescriptions. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 104.
(Poster abstract: Some effects of experimental management strategies on the temporal changes in regeneration development, stand structure, tree growth and quality in tolerant hardwood stands in south-central Ontario are illustrated by means of graphic and regression analysis. An interactive computer model demonstrates stand dynamics resulting from harvesting and silvicultural treatments.)

ANDERSON, H. W., J. RICE and J. WINTERS. (1989). Customizing clonal hybrid poplar for optimum utilization. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 79.
(Poster abstract: Methods and results of screening juvenile hybrid poplar (*Populus* spp.) clones for combinations of physical, chemical, and performance characteristics in relation to various potential end-uses are illustrated. An interactive computer application of a clonal filter was demonstrated.)

(BALATINECZ, J. J.) and H. W. ANDERSON. (1989). Effects of climatic factors on the formation of wood and its quality. *In* Proc. Forest Climate '86, Climate Applications in Forest Renewal and Forest Production, D. C. MacIver, R. B. Street and A. N. Auclair, (Eds.). Geneva Park, Orillia, Ont., 17-20 Nov. 1986. OMNR. pp. 195-200.
(Wood quality between and within trees of a species varies in response to three principal factors: (a) changes in the vascular cambium with age, (b) genetic potential within a tree, and (c) environmental influences on growth. Climatic factors of the environment influence wood formation both directly and indirectly. Results of laboratory experiments and field observations are presented on the effects of photoperiod, drought, and temperatures on wood formation in larch and hybrid poplar as typical examples.)

BUCHERT, G. P. (1989). Differential resistance to Blister Rust among open-pollinated white pine families. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, ON, 21-23 Nov. 1989. p. 85.
(Poster abstract: Open-pollinated families from seed orchard clones were infected with white pine blister rust (*Cronartium ribicola* J.C. Fischer). Differences among families indicate that certain clones are more resistant than others. Multi-year observations show that mortality among trees peaks during the second year after infection and declines rapidly in subsequent years.)

BURGER, D. (1989). Provisional site regions of eastern North America: effect of macroclimate on tree species–site relationships. *In* Proc. Forest Climate '86, Climate Applications in Forest Renewal and Forest Production, D. C. MacIver, R. B. Street and A. N. Auclair, (Eds.). Geneva Park, Orillia, Ont., 17-20 Nov. 1986. OMNR. pp. 258-261.
(Map and tables showing provisional site regions in eastern USA and their relationship to the site regions of eastern Canada.)

(COLCLOUGH, M. L.), S. J. COLOMBO and (E. BLUMWALD). (1989). The effect of high temperature conditioning on protein synthesis and heat tolerance in jack pine and black spruce. Plant Physiology 89S: 194.

(The ability of jack pine and black spruce seedlings to develop heat resistance by conditioning at high temperatures was investigated. Results clearly show that conditioning reduced needle damage in both species.)

(COLCLOUGH, M. L.), S. J. COLOMBO and (E. BLUMWALD). (1989). The effects of stress conditioning on protein synthesis and stress tolerance in conifers. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 14.
(Poster abstract: The ability of conifer seedlings to develop stress resistance by conditioning was investigated. Proteins *in vivo* were labeled with 35-S-methionine and the effects of conditioning regimes and stress on membrane and soluble proteins were examined by PAGE and autoradiography. Differences in protein synthesis in black spruce (*Picea mariana* (Mill.) B.S.P.), and jack pine (*Pinus banksiana* Lamb.) will be discussed in relation to conditioning and survival.)

COLOMBO, S. J. (1989). Root frost hardiness. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.
(Poster abstract: In Ontario, where almost all container stock is overwintered in outdoor holding areas, seedlings may be exposed to extremely low temperatures, and although seedling shoots will develop very high levels of frost hardiness, roots are unable to harden to the same extent. Assessing the risk of root freezing damage is discussed.)

COLOMBO, S. J. and (G. S. JACKSON). (1989). Assessing moisture status in tree nurseries and forest plantations using the pressure chamber. *In* Proc. Forest Climate '86, Climate Applications in Forest Renewal and Forest Production, D. C. MacIver, R. B. Street and A. N. Auclair, (Eds.). Geneva Park, Orillia, Ont., 17-20 Nov. 1986. OMNR. pp. 221-223.
(The pressure chamber is a compact, durable instrument which provides a rapid measure of the moisture status of trees. The pressure chamber will measure the tension at which water is held in the plant. This pressure, termed plant moisture stress (PMS), indicates the moisture stress of the tree.)

COLOMBO, S. J. and M. F. ASSELSTINE. (1989). Root hydraulic conductivity and root growth capacity of black spruce (*Picea mariana*). Tree Physiol. 5(1989): 73-81.
(The relationship between root elongation and root hydraulic conductivity was investigated in one-year-old, overwintered black spruce (*Picea mariana* (Mill.) seedlings. Hydraulic conductivity was estimated by observing water flux through decapitated roots under positive pressure. Five hydraulic conductivity parameters were estimated.)

COLOMBO, S. J., C. GLERUM and (D. P. WEBB). (1989). Extended greenhouse culture: improving quality and reducing damage to container seedlings. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 4.
(Poster abstract: Winter damage is a serious hazard when container seedlings are being overwintered outside. In response to the need for nursery cultural techniques, the Extended Greenhouse Culture (EGC) seedling hardening system was developed. The successful use of EGC requires monitoring of bud development and frost hardiness of seedlings as they harden in greenhouses. The resulting seedlings are of a desirable size and have high shoot and root growth potential, and the risk of winter damage in the form of frozen shoots or desiccation is reduced.)

COLOMBO, S. J., C. GLERUM and (D. P. WEBB). (1989). Winter hardening in first-year black spruce seedlings. Physiol. Plant. 76: 1-9

(Winter hardening of first-year black-spruce seedlings was studied by assessing a number of morphological and physiological changes under three hardening regimes: (1) early removal, (2) extended greenhouse culture, (3) short day.)

COLOMBO, S. J. and P. MENES. (1989). A practical test for silviculturists for predicting seedling performance in the field. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 18.
(Poster abstract: At the present time in Ontario, nursery stock is not tested to determine its physiological quality and thereby how stock will perform in the field after it is planted. One test that could fulfill this need involves root-growth potential (RGP). RGP testing can identify and prevent the planting of nursery stock with a very low RGP. This poster shows the relationship between RGP and the field survival and growth of seedlings for several important stock types.)

COLOMBO, S. J. and P. MENES. (1989). Root growth capacity and seedling quality. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 1988. 1 p.
(Poster abstract: The best available measure of seedling quality is root growth potential (RGP). RGP can be defined as the number of new roots produced by a seedling in a uniform test environment following a given test duration. RGP is a good measure of seedling quality because it integrates a number of important physiological processes into the single parameter of new root production.)

COLOMBO, S. J. and K. D. ODLUM. (1989). The silviculture and tree biology unit of the Ontario Forest Research Institute. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 27.
(Poster abstract: Research is directed toward improving forest management practices by enhancing our understanding of the physiological processes of trees that play important roles in plantation establishment and growth and is conducted in five areas from nursery stock production to stand growth and yield: (1) nursery stock production, (2) ecophysiology, (3) tree growth and productivity, (4) tree structure and physiological function, and (5) tree biochemistry.)

FARINTOSH, L. (1989). Black spruce clonal identification by isozyme analysis. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 84.
(Poster abstract: A basic manual for "how-to-do-it" electrophoresis and interpretation of black spruce (*Picea mariana* (Mill.) B.P.S.) needle isozymes was presented. Methods and equipment have been optimized so that non-scientific staff working in vegetative propagation centers can identify and differentiate between clones of black spruce for purity checks and certification.)

FORSLUND, R. and D. H. WEINGARTNER. (1989). Profile comparisons and bole volume estimates based on the paracone model. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 105.
(Poster abstract: A geometrical bole profile model based on the power function and the center of gravity of trembling aspen (*Populus tremuloides* Michx.) boles is described. One special case of the model is labeled the "paracone"—a shape midway between a parabaloid and a cone. Using the paracone, with one diameter measurement taken at the 30% position and total bole height, one can estimate volumes, with 95% confidence, to within 10% for individual trees and 3% for stands of trees.)

GILLMEISTER, D. L. (1989). Taking the pulse of Ontario's forests. Landmarks Winter 1988/89, 7(1):12-15.
(Acid rain has already damaged forests in Europe and the United States. Is Ontario next? Experts from around the world attending an Ontario conference on forest decline think they can see evidence of the changes that foreshadowed forest decline in other parts of the world.)

GLERUM, C. (1989). Take home messages for the research community. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 2 p.
(A number of areas in which knowledge of seedling growth is either lacking or deficient is discussed.)

GLERUM, C. and J. M. PATERSON. (1989). Climatic influences on jack pine and black spruce during eight growing seasons since planting on a dry and fresh site. *In* Proc. Forest Climate '86, Climate Applications in Forest Renewal and Forest Production. D. MacIver, A. N. Auclair and R. B. Street, (Eds.). Geneva Park, Orillia, Ont., 17-20 Nov. 1986. pp. 93-96.
(In 1979 black spruce and jack pine bare-root nursery stock were planted on one dry and one fresh site. The spruce were more severely damaged by frost on the fresh site but after eight growing seasons they showed differences in volume but not in height between sites. The pine on the fresh site were significantly larger in both height and volume than on the dry site.)

GORDON, A. G. (1989). Long-term ecosystem studies in natural spruce stands. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 95.
(Poster abstract: Long-term ecosystem studies are providing information that enables the prediction of a) the effects of productivity of full- or whole-tree harvesting on different landtypes, b) the constraints imposed by nutrient budgets on harvesting and rotation ages, and c) the role of acid precipitation in nutrient cycling, growth and nutrition, and stand health and stability.)

GORDON, A. G. (1989). Spruce genetics and genecology. *In* Proc. 22nd Meeting Can. Tree Improv. Assoc., Part 1, Minutes and Members' Reports, S. Magnussen and T. J. B. Boyle, (Eds.). Edmonton, Alta., 14-18 Aug. 1989. For. Can. pp. 76-80.
(The objectives of these studies are: (1) to investigate genotype x environment interaction with regard to variation in efficiency, growth and nutrition as related to site regions and productivity systems; (2) to create long-term genetic banks for gene pool and population studies, breeding, and assessment of genetic parameters to elucidate the breeding system and structure of the genus *Picea*; (3) to produce, test and select the best hybrids for propagation; (4) to develop genetic and physiological techniques for breeding juvenile trees; and (5) to utilize the arrays of spruce species and genotypes located in the *Piceta* for long-term monitoring of forest health as related to possible airborne pollution and/or climatic change.)

GORDON, A. G. and N. BALAKRISHNAN. (1989). The decline of radial growth in forest trees. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 95.
(Poster abstract: Radial growth, which is a common measure of tree or stand growth, is presented for red spruce (*Picea rubens* Sarg.). Significant changes in red spruce growth have occured in the past few decades. Some of the responses of growth reduction are considered to be stress-related, and an attempt is made to relate such responses to climate, soil chemistry and stand dynamics.)

HICKIE, D. F., C. GLERUM, Y. T. KIM and C. P. CHEN. (1989). Amino acids and sugars in dormancy release of frozen-stored jack pine and black spruce. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 11.
(Poster abstract: During storage the amino acid proline exhibits a significant positive trend and, of the six sugars (sucrose, stachyose, raffinose, glucose, fructose, xylose), stachyose shows a significant positive trend. It is intended to correlate these chemical changes with subsequent seedling vigor after outplanting.)

HIGGS, D. (1989). Variation in stomatal control of transpiration among open-pollinated jack pine families. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 85.
(Poster abstract: Transpiration rates among open-pollinated jack pine (*Pinus banksiana* Lamb.) families were measured as soil moisture decreased. Family trends were evident, an indication that families vary genetically in their ability to maintain gas exchange during soil moisture stress.)

HO, R. H. (1989). Adventitious root and shoot regeneration in cultured explants of mature black spruce. Plant Science 62: 129-135.
(Embryonic shoots with crown excised from vegetative buds of 15-35-year-old black spruce were induced to form adventitious roots from either the cortex at the shoot base or the axillary region of leaf primordia.)

HO, R. H. and O. HAK. (1989). Promotion of cone production through gibberellin $A_{4/7}$ application in spruces and pines. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 76.
(Poster abstract: Promotion of both pollen and seed cones on grafts of plus trees will enable breeders to complete a mating design and procure seeds for progeny testing. Induction of early cone production on the selected progenies will facilitate advanced generation breeding and shortening of breeding cycles to provide maximum genetic gains.)

HO, R. H. and O. HAK. (1989). Promotion of cone production through gibberellin $A_{4/7}$ application in spruces and pines. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 121.
(Workshop abstract: Promotion of both pollen and seed cones on grafts of plus trees will enable breeders to complete a mating design and procure seeds for progeny testing. Induction of early cone production on the selected progenies will facilitate advanced generation breeding and shortening of breeding cycles to provide maximum genetic gains.)

HO, R. H., Y. RAJ, M. A. BAIRD and W. J. GIBBS. (1989). *In vitro* culture of explants from mature black spruce. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 75.
(Poster abstract: Plantlets have been regenerated from explants of mature black spruce (*Picea mariana* (Mill.) B.S.P.) by rooting of the adventitious shoots, which are induced from the embryonic shoots through *in vitro* culture. Juvenility of the plantlets has been tested and serial subculture to induce juvenility will be investigated.)

HO, R. H., Y. RAJ, M. A. BAIRD and W. J. GIBBS. (1989). *In vitro* culture of explants from mature black spruce. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 118.

(Workshop abstract: Plantlets have been regenerated from explants of mature black spruce (*Picea mariana* (Mill.) B.S.P.) by rooting of the adventitious shoots, which are induced from the embryonic shoots through *in vitro* culture. Juvenility of the plantlets has been tested and serial subculture to induce juvenility will be investigated.)

KIM, Y. T. and C. GLERUM. (1989). A possible role of the seasonal free amino acid fluctuations in coniferous foliage. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 89.
(Poster abstract: Free amino acid concentrations in red pine (*Pinus resinosa* Ait.) and white spruce (*Picea glauca* (Moench) Voss) needles fluctuate annually, but only the amino acid tryptophan consistently exhibits a significant trend from low concentration in summer to increasing concentration in fall and decreasing concentration in spring. Since tryptophan is the precursor of the well-known plant hormone indole-acetic acid, it is suspected that the tryptophan decrease is associated with the increase in indole-acetic acid, which plays a vital role in plant growth with the onset of growth in spring. It is suggested that tryptophan might be a good "indicator compound" for determining the stage of dormancy.)

KOPPENAAL, R. S. (1989). Conditioning current-crop container stock to drought and high temperatures. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.
(Poster abstract: This stock type is the most susceptible to post-planting environmental stresses including drought and high temperatures. Cultural treatments which condition seedlings to stress can increase survival on harsh planting sites. Seedlings exposed to drought or moderately high temperatures in the greenhouse can increase post-planting stress resistance.)

KOPPENAAL, R. S. and S. J. COLOMBO. (1989). Stress-conditioning spruce and pine container stock. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 4.
(Poster abstract: In laboratory trials, heat-conditioned white spruce (*Picea glauca* (Moench) Voss), black spruce (*Picea mariana* (Mill.) B.S.P.) and jack pine (*Pinus banksiana* Lamb.) seedlings suffered little or no damage after exposure to very high temperatures (38-50°C) that were lethal to normal current-crop stock that received no conditioning. Research indicates that exposure of current-crop container spruce and pine to temperatures of 38-40°C increases their tolerance to otherwise lethal temperatures that can occur at the soil surface of cleared boreal planting sites.)

(LAUGHTON, P. J.), C. S. PAPADOPOL and P. JACIW. (1989). Zero discharge through innovative application of intensive silviculture to effluent disposal from a small Canadian wastewater treatment plant. *In* Small Wastewater Treatment Plants, Norway, 1989. pp. 237-244.
(The design and practical experience gained from the operation of a small activated sludge wastewater treatment facility, incorporating zero effluent discharge through evapotranspiration utilizing a multi-clonal poplar forest, is described. Secondary treated effluent was seasonally applied to a forested plantation through an automated sprinkler system with the rate being calculated daily based on information from an automated weather station and using a modified Penman approach.)

LUSSIER, N. (1989). Comparative growth of 20 provenances of red spruce after 27 years of growth. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 96.

(Poster abstract: Twenty provenances of red spruce (*Picea rubens* Sarg.) in a plantation are compared and ranked according to height and diameter after 27 years of growth. Volume and growth curves are also shown.)

MACDONALD, G. B. (1989). Elements of an effective competition index for young boreal plantations. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 122.
(Workshop abstract: It was determined from hemispherical photographs that measures of above-ground competition were strongly correlated with growth. Effective mensurational components included competitor density, basal area sum, and relative average height. A series of competition indices were derived and compared for reliability in predicting seedling growth for the two species and stock types studied (i.e. black spruce (*Picea mariana* (Mill.) B.S.P.) and jack pine (*Pinus banksiana* Lamb.); bare-root and overwintered containers). Reliable competition indices should include horizontal and vertical dimensions and express the amount of competition in relation to the size of the seedling.)

MCCLAIN, K. M. (1989). Introduction to the planting trials: The nuts and bolts. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.
(There is considerable opportunity to improve the overall success of the reforestation program by the implementation of new or improved approaches to the way we grow trees and the way we carry out silviculture. The planting trials will guide future directions.)

MCCLAIN, K. M. (1989). Scheduled planting can make the difference between... *In* Forestry Research Marketplace (Supplement), OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 5.
(Poster abstract: Scheduling the field planting of nursery conifer crops can make the difference between plantations that will meet management objectives and those that will not. Comparative 13-year results from a black spruce (*Picea mariana* (Mill.) B.S.P.) plantation planted at biweekly intervals on a productive till-loess capped site in the district of Thunder Bay, Ontario, clearly demonstrates the need for careful consideration of stock type and planting time to schedule a planting program effectively.)

MCCLAIN, K. M. (1989). Scheduling can make the difference between... *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.
(Poster abstract: Comparative 13-year results from a black spruce plantation planted at biweekly intervals on a production till-loess capped site near Thunder Bay, Ontario, clearly demonstrates the need for careful consideration of stock types and planting times to effectively schedule a planting program.)

MCCLAIN, K. M. and (D. P. LAVENDER). (1989). Tissue water relations and survival of conditioned conifer seedlings during drought stress. *In* Proc. 10th North American For. Biol. Workshop, Vancouver, B.C., 20-22 July 1988. pp. 177-185.
(The effects of drought stress and nutrient conditioning on the tissue water relations and survival of jack pine and Douglas-fir seedlings subjected to an eight-week drought stress period on two soil types are discussed.)

MCCLAIN, K. M., J. ELLIOTT and T. CASELLA. (1989). Determination of container seedling vitality and prediction of field performance. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 6.
(Poster abstract: Survival, rates of bud flush, relative root development, time to 50% mortality under dry soil conditions, and biomass production were determined and related to field performance. Seedlings that exhibited diminished performance in the greenhouse did so in the field as well.)

MENES, P. (1989). Root soaking. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.
(Poster abstract: Research has shown that non-stressed nursery stock does not benefit from root soaking and, if applied improperly, rook soaking can itself be detrimental to stock vigor.)

MENES, P. (1989). Root soaking of bare-root coniferous stock. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 12.
(Poster abstract: Root soaking, the immersion of roots of bare-root planting stock in water before outplanting, is a procedure generally believed to reduce plant moisture stress. However, the root-soaking procedure itself can be the source of stress if roots are soaked for prolonged periods in water depleted of oxygen.)

MORRIS, D. M. (1989). The development of a competition index for young boreal plantations in northern Ontario. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 123.
(Workshop abstract: Eradicating perennial competition from young boreal plantations is expensive, and requires a selective application based on the relationship between plantation productivity and competition level. It was determined from hemispherical photographs that measures of above-ground competition were strongly correlated with growth. Effective mensurational components included competitor density, basal area sum, and relative average height. A series of competition indices were derived and compared for reliability in predicting seedling growth for the two species and stock types studied (i.e. black spruce (*Picea mariana* (Mill.) B.S.P.) and jack pine (*Pinus banksiana* Lamb.); bare-root and overwintered containers). Graphical and statistical comparisons of growth response curves for the two species and stock types across a range of site types were presented.)

MORRIS, D. M. and G. B. MACDONALD. (1989). The development of a competition index for young boreal plantations in northern Ontario. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 33.
(Poster abstract: It was determined from hemispherical photographs that measures of above-ground competition were strongly correlated with growth. Effective mensurational components included competitor density, basal area sum, and relative average height. A series of competition indices were derived and compared for reliability in predicting seedling growth for the two species and stock types studied (i.e. black spruce (*Picea mariana* (Mill.) B.S.P.) and jack pine (*Pinus banksiana* Lamb.); bare-root and overwintered containers). Graphical and statistical comparisons of growth response curves for the two species and stock types across a range of site types were presented.)

(MOSSELER, A.) and C. S. PAPADOPOL. (1989). Seasonal isolation as a reproductive barrier among sympatric *Salix* species. Can. J. Bot. 67(9): 2563-2570.

(Differences in flowering phenology may be an important premating reproductive barrier between willow species. Thermal control over flowering phenology was related to cumulative growing degree-days. The inheritance of phenological responses in artificially produced F1 interspecific hybrids was intermediate between that of the parental species.)

ODLUM, K. D. (1989). The effect of night temperatures on bud initiation in black spruce seedlings. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 5.
(Poster abstract: In black spruce (*Picea mariana* (Mill.) B.S.P.) container seedling production, overwinter damage can often be attributed to the failure of actively growing seedlings to initiate buds quickly and subsequently to attain acceptable levels of frost hardiness in the fall before outside temperatures become extreme. Greenhouse temperatures during bud initiation may dramatically influence the time required for seedlings to initiate buds.)

ODLUM, K. D. (1989). Short day treatment for dormancy induction in containerized black spruce seedlings. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.
(Poster abstract: Short day (SD) exposure in greenhouse seedling production allows growers to terminate seedling height growth and induce budset and dormancy in a crop quickly and uniformly, at any time of year.)

ODLUM, K. D. (1989). Short-day exposure in the greenhouse influences field performance. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 6.
(Poster abstract: Short-day (SD) exposure in greenhouse black spruce (*Picea mariana* (Mill.) B.S.P.) seedling production allows growers to terminate seedling height growth and induce budset in a crop quickly and uniformly, at any time of year.)

ODLUM, K. D. and S. J. COLOMBO. (1989). The influence of night temperature under declining photoperiod on bud initiation in black spruce seedlings. Can. J. For. Res. 19(2): 274-275.
(The effect of night temperature on the speed of bud initiation in black spruce container seedlings was examined using day lengths progressively shortened to simulate the natural day-length decline that occurs in the fall at latitude 48°N.)

ODLUM, K. D. and S. J. COLOMBO. (1989). Night temperature control of bud initiation. *In* Proc. Forest Climate '86, Climate Applications in Forest Renewal and Forest Production, D. C. MacIver, R.B. Street and A.N. Auclair, (Eds.). Geneva Park, Orillia, Ont., 17-20 Nov. 1986. p. 278.
(Poster abstract: The time required for black spruce (*Picea mariana* (Mill.) B.S.P.) container seedlings to initiate buds and to subsequently reach acceptable levels of frost hardiness is profoundly affected by greenhouse night temperatures. Night temperatures less than 10°C or above 26°C dramatically increased the time required for seedlings to attain 100% bud initiation.)

PAPADOPOL, C. S. (1989). Advanced irrigation and soil-water budgeting system for tree nurseries. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 13.
(Poster abstract: Optimization of irrigation is particularly critical for sustained growth of seedlings, minimization of fertilizer leaching, and avoidance of wasteful expansion of energy and wear and tear on irrigation equipment. This irrigation package based on artificial intelligence, can eventually

lead to automation of the entire irrigation activity for sensitive species and for areas where intensive culture is practiced.)

PAPADOPOL, C. S. (1989). Operational software for integrated simulation of weather and soil influences on nursery crops. *In* Proc. Forest Climate '86, Climate Applications in Forest Renewal and Forest Production, D. C. MacIver, R. B. Street and A. N. Auclair, (Eds.). Orillia, Ont., 17-20 Nov. 1986. pp. 234-240.

(A computer simulation model describing the unidimensional flow of water through typically cropped nursery soil was developed. The model simulates the water balance of a dense, growing crop of seedlings that transpires in response to atmospheric demand for evapotranspiration and extracts water from a flow that percolates the soil matrix. Weather input data for the model consist of hourly measurements of global shortwave radiation, air temperature, relative humidity, and wind.)

PAPADOPOL, C. S. and P. JACIW. (1989). A new and reliable method for monitoring the flow of maple sap. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 91.

(Poster abstract: This method allows for automated monitoring of the sap flow and of several related environmental parameters that influence it. Apart from shedding additional light on the physiology of sap translocation, automated monitoring of maple sap flow may also support studies related to sugar maple decline, to selection of the most productive trees and to the use of fertilizers as a means of reversing growth decline.)

PAPADOPOL, C. S. and P. JACIW. (1989). Reconstituted soil-water supply regime and growth of red pine. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 92.

(Poster abstract: A red pine (*Pinus resinosa* Ait.) stand on deep sandy soil in East Gwillimbury Twp., Ontario, was monitored. On the basis of local determinations of soil hydraulic conductivity, historic weather records and a model of soil-water transport, the water stress on this stand during the growing season has been reconstituted for 20 years and crossdated with the tree-ring widths. Although red pine can survive extreme water stress, its ring width is highly correlated with the number of days on which soil-water supply is favourable.)

PATERSON, J. M. (Contributor). (1989). *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988.

(Reports on the planting stock trials conducted within the Northern Region during 1987 and 1988, showing survival and growth of both container and bare-root stock types under carefully controlled conditions, and under normal operational conditions.)

PATERSON, J. M. and C. GLERUM. (1989). Good planting pays. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.

(Poster abstract: In 1976 a research study was initiated to look at the effects of handling and planting on the field performance of 3+0 red pine (*Pinus resinosa* Ait.). In the tenth year, survival, total height and diameter at breast height were assessed and basal area per hectare was calculated. After 10 years there was an overall loss in basal area of 27% in the operational planting as opposed to the research planting.)

(Differences in flowering phenology may be an important premating reproductive barrier between willow species. Thermal control over flowering phenology was related to cumulative growing degree-days. The inheritance of phenological responses in artificially produced F1 interspecific hybrids was intermediate between that of the parental species.)

ODLUM, K. D. (1989). The effect of night temperatures on bud initiation in black spruce seedlings. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 5.
(Poster abstract: In black spruce (*Picea mariana* (Mill.) B.S.P.) container seedling production, overwinter damage can often be attributed to the failure of actively growing seedlings to initiate buds quickly and subsequently to attain acceptable levels of frost hardiness in the fall before outside temperatures become extreme. Greenhouse temperatures during bud initiation may dramatically influence the time required for seedlings to initiate buds.)

ODLUM, K. D. (1989). Short day treatment for dormancy induction in containerized black spruce seedlings. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.
(Poster abstract: Short day (SD) exposure in greenhouse seedling production allows growers to terminate seedling height growth and induce budset and dormancy in a crop quickly and uniformly, at any time of year.)

ODLUM, K. D. (1989). Short-day exposure in the greenhouse influences field performance. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 6.
(Poster abstract: Short-day (SD) exposure in greenhouse black spruce (*Picea mariana* (Mill.) B.S.P.) seedling production allows growers to terminate seedling height growth and induce budset in a crop quickly and uniformly, at any time of year.)

ODLUM, K. D. and S. J. COLOMBO. (1989). The influence of night temperature under declining photoperiod on bud initiation in black spruce seedlings. Can. J. For. Res. 19(2): 274-275.
(The effect of night temperature on the speed of bud initiation in black spruce container seedlings was examined using day lengths progressively shortened to simulate the natural day-length decline that occurs in the fall at latitude 48°N.)

ODLUM, K. D. and S. J. COLOMBO. (1989). Night temperature control of bud initiation. *In* Proc. Forest Climate '86, Climate Applications in Forest Renewal and Forest Production, D. C. MacIver, R.B. Street and A.N. Auclair, (Eds.). Geneva Park, Orillia, Ont., 17-20 Nov. 1986. p. 278.
(Poster abstract: The time required for black spruce (*Picea mariana* (Mill.) B.S.P.) container seedlings to initiate buds and to subsequently reach acceptable levels of frost hardiness is profoundly affected by greenhouse night temperatures. Night temperatures less than 10°C or above 26°C dramatically increased the time required for seedlings to attain 100% bud initiation.)

PAPADOPOL, C. S. (1989). Advanced irrigation and soil-water budgeting system for tree nurseries. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 13.
(Poster abstract: Optimization of irrigation is particularly critical for sustained growth of seedlings, minimization of fertilizer leaching, and avoidance of wasteful expansion of energy and wear and tear on irrigation equipment. This irrigation package based on artificial intelligence, can eventually

lead to automation of the entire irrigation activity for sensitive species and for areas where intensive culture is practiced.)

PAPADOPOL, C. S. (1989). Operational software for integrated simulation of weather and soil influences on nursery crops. *In* Proc. Forest Climate '86, Climate Applications in Forest Renewal and Forest Production, D. C. MacIver, R. B. Street and A. N. Auclair, (Eds.). Orillia, Ont., 17-20 Nov. 1986. pp. 234-240.
(A computer simulation model describing the unidimensional flow of water through typically cropped nursery soil was developed. The model simulates the water balance of a dense, growing crop of seedlings that transpires in response to atmospheric demand for evapotranspiration and extracts water from a flow that percolates the soil matrix. Weather input data for the model consist of hourly measurements of global shortwave radiation, air temperature, relative humidity, and wind.)

PAPADOPOL, C. S. and P. JACIW. (1989). A new and reliable method for monitoring the flow of maple sap. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 91.
(Poster abstract: This method allows for automated monitoring of the sap flow and of several related environmental parameters that influence it. Apart from shedding additional light on the physiology of sap translocation, automated monitoring of maple sap flow may also support studies related to sugar maple decline, to selection of the most productive trees and to the use of fertilizers as a means of reversing growth decline.)

PAPADOPOL, C. S. and P. JACIW. (1989). Reconstituted soil-water supply regime and growth of red pine. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 92.
(Poster abstract: A red pine (*Pinus resinosa* Ait.) stand on deep sandy soil in East Gwillimbury Twp., Ontario, was monitored. On the basis of local determinations of soil hydraulic conductivity, historic weather records and a model of soil-water transport, the water stress on this stand during the growing season has been reconstituted for 20 years and crossdated with the tree-ring widths. Although red pine can survive extreme water stress, its ring width is highly correlated with the number of days on which soil-water supply is favourable.)

PATERSON, J. M. (Contributor). (1989). *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988.
(Reports on the planting stock trials conducted within the Northern Region during 1987 and 1988, showing survival and growth of both container and bare-root stock types under carefully controlled conditions, and under normal operational conditions.)

PATERSON, J. M. and C. GLERUM. (1989). Good planting pays. *In* "Return to Fitness for Purpose" Symposium, Timmins, Ont., 6-8 Dec. 1988. 1 p.
(Poster abstract: In 1976 a research study was initiated to look at the effects of handling and planting on the field performance of 3+0 red pine (*Pinus resinosa* Ait.). In the tenth year, survival, total height and diameter at breast height were assessed and basal area per hectare was calculated. After 10 years there was an overall loss in basal area of 27% in the operational planting as opposed to the research planting.)

PATERSON, J. M. and C. GLERUM. (1989). Complexities of artificial regeneration. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 21.
(Poster abstract: Results from current research trials in Ontario are integrated to show some of the complexities of artificial regeneration. Morphological stock characteristics, some of which can be controlled during the growing phase at the nursery, and physiological influences imparted during the growing, handling and planting phases of the operation can influence how well nursery stock survives and grows after planting.)

PATERSON, J. M. and R. E. HUTCHISON. (1989). Red pine, white pine, white spruce stock type comparisons. OMNR For. Res. Note No. 47: 4 p. (OMNR 3988-1)
(This report compares the field performance of several red pine (*Pinus resinosa* Ait.), white pine (*P. strobus L.)* and white spruce (*Picea glauca* (Moench) Voss) stock types after seven growing seasons.)

RACEY, G., C. GLERUM and R. HUTCHISON. (1989). Interaction of stock type and site with three coniferous species. OMNR For. Res. Rep. No. 124: 12 p. (OMNR 4343)
(Various stock types of white spruce (*Picea glauca* (Moench) Voss), white pine (*Pinus strobus* L.) and red pine (*Pinus resinosa* Ait.) were planted on several sites with large variation in degree of vegetative competition. A program of stock-type testing is recommended to identify the suitability of new stock types for specific sites.)

RAJ, Y. and R. H. HO. (1989). *In vitro* propagation of some conifers by cotyledon and epicotyl culture. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 75.
(Poster abstract: Plantlets have been regenerated from segments of cotyledons and epicotyls in black spruce (*Picea Mariana* (Mill.) B.S.P.), white spruce, (*P. glauca* (Moench) Voss), jack pine (*Pinus banksiana* Lamb.), and eastern white pine (*P. strobus* L.). Explants from 50 black spruce germinants were cultured separately for each seedling order to study the extent of clonal variation within a species. Explants from about 50% of the germinants produced only calli. Therefore, screening of seed is very important for success in cloning.)

RAYMOND, F. (1989). Dimensional growth, difference-based equations and growth predictions. OMNR For. Res. Rep. No. 123: 19 p. (OMNR 4342)
(Searching for equations to fit the typically fluctuating growth rates in various dimensions of essentially mature trees disclosed that non-constant growth rates require difference-based equations rather than differential-based equations. Correctable or dynamic predictions based on dynamic equations responsive to changing growth rates appear to offer the greatest promise for satisfactory prediction of future growth.)

(ROY, D. N.), (G. C. DEKA), G. P. BUCHERT and (B. M. WONG). (1989). Chemical characteristics and pulping behaviour as criteria for use in selecting superior jack pine. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 83.
(Poster abstract: Twenty-five jack pine (*Pinus banksiana* Lamb.) plus trees were sampled at breast height to determine chemical characteristics and pulping behaviour. The energy of activation in this study represents actual energy required to remove bulk lignin and was found to be 91 kJ/mol in both sapwood and heartwood. This would indicate that there may be no difference in delignification kinetics between a plantation-grown and a naturally grown tree.)

SKEATES, D. A., D. E. IRVING and (V. F. HAAVISTO). (1989). Deterioration of black spruce seed during in-situ storage and processing. USDA For. Serv. Tree Plant. Notes 40(3): 5-8.
(Cones of four age classes were collected from 65 black spruce trees. After three extraction cycles for each cone, germination tests were conducted. Seed from older cones exhibited lower germination capacity, but extraction cycles did not reduce total viability. Implications for subsequent production of different stock products are discussed.)

STROEMPL, G. (1989). Red oak regeneration program in Ontario: An overview of management and research. *In* Proc. 4th Wkshp. Seedling Physiol. & Growth Problems in Oak Plantings, Columbus, Ohio, 1-2 Mar. 1989. 4 p.
(Some industries depend on good-quality oak, and demand for sawlogs and veneer in Southern Ontario is expected to double by the year 2025. These factors justify promotion of the regeneration and growing of red oak.)

STROEMPL, G., (D. DUEGO), (K. WRIGHT), (P. SECKER), (H. METCALF), (M. SCHENK) and (B. FLECK). (1989). Red oak regeneration program in Ontario. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 23.
(Poster abstract: The primary factors that must be controlled to ensure establishment of red oak by any regeneration method are vegetation competition and damage caused by animals, primarily browsing by deer. Chemicals are effective in controlling competition; however, establishment will not be secured unless red oak is individually protected where animal damage is the limiting factor.)

WEINGARTNER, D. H. (1989). The climax in the life of a stand: Optimum biological rotation. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 26.
(Poster abstract: The culmination of the mean tree MAI may provide a suitable reference point. Determining the mean tree MAI on the basis of local volume tables (variable density tables for stagnating species) corresponding to Forest Ecosystem Classification (FEC) vegetation and site types will provide a valuable decision-making tool when extensively managed stands are being scheduled for harvest. It will also provide direction for release operations as management intensifies.)

WEINGARTNER, D. H. and (R. DOUCET). (1989). The quest for aspen management in eastern Canada. *In* Aspen Symposium '89, R.D. Adams, (Ed.). Duluth, Minnesota, 25-27 July 1989. Gen. Tech. Report NC-140. USDA For. Serv. pp. 61-71.
(In eastern Canada, aspen represents 0.03% to nearly 20% of the individual growing stock volumes. Regional and local differences in growing stock volume and markets influence the management view of the resource. Previous silvicultural efforts were directed at eliminating aspen in favour of softwoods. Precommercial and commercial thinning of aspen in pure and mixedwood stands may be key treatments in managing this increasingly important resource.)

WEINGARTNER, D. H. and R. COLLIER. (1989). A selective herbicide applicator for use with glyphosate. *In* Forestry Research Marketplace, OFRC Symposium Proceedings O-P-18, Toronto, Ont., 21-23 Nov. 1989. p. 36.
(Poster abstract: Glyphosate is a non-selective herbicide and can be applied over conifers only when they are dormant; however, in high value areas control of adjacent competing vegetation in

midsummer would be beneficial. A selective wiper applicator composed mostly of standard hardware items was described.)

ANDERSON, H. W., (B. D. BATCHELOR), (C. M. CORBETT), (A. S. CORLETT), (D. T. DEUGO), (C. F. HUSK) and (W. R. WILSON). (1990). A silvicultural guide for the tolerant hardwoods working group in Ontario. OMNR Sci. & Tech. Series No. 7: 178 p.
(This guide provides a description of silviculture practices and characteristics. The guide may be used by the management forester as a source of infomation and data, which with knowledge, can form the basis for the development of silvicultural prescriptions in the timber management process.)

BALAKRISHNAN, N. and A. G. GORDON. (1990). The decline of radial growth in spruce trees in Algonquin District, Ontario. *In* Research in Forest Inventory, Monitoring, Growth and Yield, Proc. IUFRO Joint sessions of S4.02 and S4.01, Montreal, Quebec, 5-11 Aug. 1990. p.497.
(Long-term climatic changes were investigated for correlation with growth changes. Preliminary investigation suggests that: (a) there are indications that while climatic changes may have contributed to observed changes, the degree of radial growth suppression observed is greater than would be expected based on past growth-climate relationships; (b) this suggests a unique combination of climatic stresses or the possibly interactive intervention of other regional-scale stresses such as atmospheric pollution.)

BURGER, D. and G. PIERPOINT. (1990). Trends in forest site and land classification in Canada. For. Chron. 66(2): 91-96.
(Classification trends during the past 60 years, including the adaptation of European vegetation typology to Canadian conditions to the most recent trend of primesite classification combining land features and technologic and socio-economic criteria are reviewed.)

(COLCLOUGH, M. L.), S. J. COLOMBO and (E. BLUMWALD). (1990). The induction of heat tolerance in black spruce seedlings. Plant Physiology 93S: 512.
(Heat conditioning of black spruce seedlings at 38°C drastically reduced heat-induced damage of seedlings exposed to 49-52°C. The patterns of protein synthesis during heat conditioning and heat stress were studied.)

COLOMBO, S. J. (1990). Bud dormancy status, frost hardiness, shoot moisture content, and readiness of black spruce container seedlings for frozen storage. J. Amer. Soc. Hort. Sci. 115(2): 302-307.
(Black spruce (*Picea mariana* (Mill.) B.S.P.) first-year seedlings were exposed to 8hr photoperiods and warm temperatures (26°C maximum, 15°C minimum) and tested weekly to determine bud dormancy status, frost hardiness, shoot moisture content, and the amount of damage caused by a period of frozen storage (-3°C). Bud dormancy status, frost hardiness, and shoot moisture content were all strongly correlated to the time of bud initiation.)

COLOMBO, S. J. (1990). Heat tolerance of clonal black spruce. *In* Proc. Annual Meeting of the Black Spruce Clonal Forestry Program, Timmins, Ont., Feb. 1990. pp. 10-17.
(This paper presents preliminary results of a study of variability in heat tolerance between clones of black spruce produced from rooted cuttings at the Northern Clonal Forestry Centre.)

COLOMBO, S. J. and R. S. KOPPENAAL. (1990). Heat: the neglected stress. *In* Proc. IUFRO XIX World Congress, Division 2, Montreal, Quebec, 5-11 Aug. 1990. Division 2. p. 48.
(Investigations have shown that foliar heat tolerance varies according to several factors, among which are state of growth, temperature, nutrition, time of day, and clone.)

GLERUM, C. (1990). Stock production research in Canada: a historical perspective. For. Chron. 66(2): 103-111.
(The development of stock production research in Canada is described tracing the evolution from bare-root stock production to containerized stock production. Some of the more significant findings in stock production research on such topics as storage, fertilization, frost hardiness, photoperiodicity and root growth are briefly described.)

GORDON, A. G. (1990). A comparative study of 20-year history of soil chemistry under a long-residence conifer, long-residence hardwood, and long-residence hardwood converted to spruce plantation in Ontario, Canada. *In* Proc. XIX IUFRO World Congress, Montreal, Quebec, 5-11 Aug. 1990. P2. 05-04.
(The idea that fully developed long-residence forests normally exhibit little or no change over long periods of time should now be considered in the context of climatic and pollution related environmental changes. The key to resistance to any changes lies partly in the soil capacity to buffer any external influences that may otherwise cause significant soil chemistry changes. It is concluded that the tight and precariously conserved nature of the calcium budget is a contributing factor permitting continued stability, for the present.)

GORDON, A. G. (1990). Crossability in the genus *Picea* with special emphasis on the Mexican species. *In* Proc. Joint Meeting of Western Forest Genetics Association and IUFRO Working Parties S2.02-05, 06, 12 and 14, Douglas-fir, Contorta Pine, Sitka Spruce and Abies Breeding and Genetic Resources, Olympia, Washington, USA, 1990. 4 p.
(This paper presents the results of interspecific breeding and phylogenetic studies focusing on *Picea chihuahuana* and *Picea mexicana*.)

GORDON, A. G. (1990). *Picea* research, Swan Lake Forest Research Reserve. IUFRO tour, 14 Aug. 1990.
(A description of the Mikado Picetum, the Scott Lake Picetum and the Scott Lake red spruce provenance experiment.)

GORDON, A. G. (1990). Supplementing the population restoration of *Picea mexicana* in Nuevo Leon, Mexico. *In* Proc. North American Forestry Commission, Forest Genetics Working Group Meeting, Mexico City, Mexico, 2 Aug. 1990. 6p.
(A short history of the research and propagation of *Picea mexicana* since its discovery and description in 1961.)

(LAUGHTON, P. J.), C. S. PAPADOPOL and P. JACIW. (1990). Wastewater reuse and nutrient recycling through intensive silviculture. *In* Proc. International Wastewater Disposal Conference, Barcelona, Spain, 1990. 12 p.

(LAUGHTON, P. J.), C. S. PAPADOPOL and P. JACIW. (1990). Zero discharge through innovative application of intensive silviculture to effluent disposal from a small Canadian wastewater treatment plant. Wat. Sci. Tech. 22(3/4): 217-224.
(On the basis of the results of studies to date, it would appear that intensive silviculture incorporating cultivated plantations of poplar and other species can be used as biological reprocessors for treated effluent at a considerably higher effectiveness than grass. During the six years in which irrigation was practised with secondary effluent, no adverse effect on the clones

was recorded. The crown development of trees increased the trees consumptive ability as well as their ability to hold and and evaporate water directly from the leaves.)

LEECH, R. H. and Y. T. KIM. (1990). Methods to investigate fertilization as a means to improve growth and sugar yield of sugar maple. Soil Sci. Plant Anal. 21(17&18): 2029-2051.
(NPKCa fertilizers were applied annually for five years to a mature sugar maple (*Acer saccharum* Marsh.) woodlot in southern Ontario. Effects of fertilizer treatments on sugar yield were shown to be significant when the area of crown overlap of competing trees was subtracted from the crown area of crop trees. Sap analysis showed significant relations between sap nutrients and diameter growth.)

MACDONALD, G. B. (1990). Comparative responses of *Picea mariana* and *Pinus banksiana* seedlings to interspecific competition. *In* Proc. IUFRO XIX World Congress, Science in Forestry, Montreal, Quebec, 5-11 Aug. 1990. 1 (2). p. 399.
(Indices of interspecific competition were formulated and tested for their ability to explain variation in diameter increment of black spruce (*Picea mariana* (Mill.) B.S.P.) and jack pine (*Pinus banksiana* Lamb.) seedlings. The optimum index was calculated as the amount of competing canopy on hemispherical fisheye photographs, relative to the seedling leaf area.)

MACDONALD, G. B., D. M. MORRIS and (P. L. MARSHALL). (1990). Assessing components of competition indices for young boreal plantations. Can. J. For. Res. 20(7): 1060-1068.
(This study tested candidate components of a competition index based on growth relationships at a fixed seedling age.)

MENES, P. (1990). The effect of site storage conditions on temperature. *In* Proc. Stock Handling Workshop, North Bay, Ont., 20 Mar. 1990. COFTDU. pp. 46-68.
(Proper storage at the planting site will reduce exposure by protecting the stock from unfavourable environmental conditions—one of the key ones being temperature. This paper discusses how site storage conditions affect temperature and the effect that temperature has on seedlings.)

MORRIS, D. M., G. B. MACDONALD and K. M. MCCLAIN. (1990). Evaluation of morphological attributes as response variables to perennial competition for 4-year-old black spruce and jack pine seedlings. Can. J. For. Res. 20(11): 1696-1703.
(The sensitivity of seedling morphological attributes to changing competition levels was evaluated on 4-year-old black spruce and jack pine seedlings. The results from this study demonstrated that total height or current height increment were not reliable for quantifying individual seedling response to interspecific competition for 4-year-old black spruce or jack pine plantations. The most consistent response variable was total seedling dry weight.)

PAPADOPOL, C. S. (1990). Irrigation rate calculation for nursery crops. USDA For. Serv. Tree Plant. Notes 41(4): 22-27.
(The atmospheric approach for irrigation rate calculation rests upon firm physical principles, is based on well research models, and with the help of available high-tech equipment, lends itself to unattended operation. Application of irrigation rates determined on this basis prevents overwatering and leaching of nutrients, particularly NO_3, from sandy nursery soils.)

PATERSON, J. M. (1990). Consequences of poor seedling handling. *In* Proc. Stock Handling Workshop, North Bay, Ont., 20 Mar. 1990. COFTDU. pp. 69-75.

(Stress has been defined as an environmental cue that causes seedlings to shift their metabolic efforts toward survival rather than maintenance and growth. Ensuring that proper care is applied in the handling and planting of small seedling stock will reduce the risk of stresses which could doom the seedling to failure and eventual death.)

RAJ, Y., R. H. HO, W. J. GIBBS and M. A. BAIRD. (1990). *In vitro* studies on adventitious shoot formation from embryonic shoots of black spruce. *In* Proc. 22nd Can. Tree Improv. Assoc., Part 2, Tree Improvement—Picking the Winners, F. C. H. Yeh, F. I. Klein and S. Magnussen (Eds.). Edmonton, Alta., 14-18 Aug. 1989. For. Can. p. 87.
(Plantlets have been successfully regenerated from embryonic shoots of mature black spruce (*Picea mariana* (Mill.) B.S.P.) trees. The factors that influence the induction and elongation of adventitious shoots were studied.)

STROEMPL, G. (1990). Deeper planting of seedlings and transplants increases plantation survival. USDA For. Serv. Tree Plant. Notes 41(4): 17-21.
(Heat, often confused with drought, is probably the most overlooked cause of death of newly transplanted bare-root trees. The transition zone where root and stem meet, the stem-root junction, has been identified as an area which needs protection by deeper planting.)

VANHINSBERG, N. B. and S. J. COLOMBO. (1990). Effect of temperature on needle anatomy and transpiration of *Picea mariana* after bud initiation. Can. J. For. Res. 20(5): 598-601.
(Six-month-old black spruce (*Picea mariana* (Mill.) B.S.P.) container seedlings were placed in either a cool (18 ± 4 / 6 ± 4°C, light/dark) or a warm (26 ± 3 / 18 ± 2°C, light/dark) hardening regime for 12 weeks after bud initiation to assess the effects of temperature on needle maturation and transpiration.)

COLOMBO, S. J. (1991). Heat tolerance of tree seedlings and its importance to nursery managers. *In* Proc. 1990 Prairie Tree Nursery Association, Man., 10-12 Sept. 1990. pp. 42-61.
(Heat tolerance and heat damage are important factors which affect container seedling production in Canada. Like freezing, heat is a stress experienced by trees, and both heat and frost are responsible for damage and mortality in container nurseries. This paper describes some factors which influence the heat tolerance of tree seedlings, and what importance this has in container nursery management.)

COLOMBO, S. J. and (E. M. RAITANEN). (1991). Frost hardening in white cedar container seedlings exposed to intermittent short days and cold temperatures. For. Chron. 67(5): 542-544.
(Shoot frost hardiness development in white cedar (*Thuja occidentalis* L.) container seedlings in response to intermittent short days (days per week) and warm (not less than 15°C) or cool (10/5°C, day/night) temperatures was assessed using the diffusate-electrical conductivity technique.)

FORSLUND, R. (1991). The power function as a simple stem profile examination tool. Can. J. For. Res. 21(2): 193-198.
(Formulae are presented for calculating the volume, surface area, centre of gravity, centre of mass, form taper, and instantaneous slope of the power function. A profile plotting technique is also used that allows visual comparisons between average stem profiles independent of the size and taper of individual stems.)

GORDON, A. G. (1991). Genetics, genecology and breeding in the genus *Picea* L. (spruce). *In* Maintaining Diversity: "Should We Be Concerned?" S. Magnussen, J. Lavereau and T. J. Boyle, (Eds.). Ottawa, Ont., 19-23 Aug. 1991. Forestry Canada. pp. 86-88.
(The objectives of these studies are: (1) to quantify genotype x environment interaction as part of a breeding strategy for selecting desirable spruce genotypes for maintaining genetic variability and diversity in spruce forest ecosystems, and for developing hybrids for 'new forests' under changing environmental regimes; (2) to investigate G x E interaction by determining genetic variation in efficiency, growth and nutrition and productivity; (3) to create long-term genetic banks for gene pool and population studies; (4) to produce, test and select the best hybrids for propagation; (5) to utilize the *Piceta* for long-term monitoring of forest health as related to possible airborne pollution and/or climatic change.)

HO, R. H. (1991). A guide to pollen- and seed-cone morphology of black spruce, white spruce, jack pine and eastern white pine for controlled pollination. OMNR For. Res. Rep. No. 125: 31 p. (OMNR 4645)
(This paper describes pollen- and seed-cone morphology and development, pollen-cone collection for pollen extraction, pollen forcing, seed-cone stages for isolation and receptivity for pollination, the pollination mechanism, and pollination techniques in black (*Picea mariana*) and white spruce (*P. glauca*) and jack (*Pinus banksiana*) and eastern white pine (*P. strobus*).)

HO, R. H. (1991). Cone induction and tissue culture studies. *In* Maintaining Diversity: "Should We Be Concerned?" S. Magnussen, J. Lavereau and T. J. Boyle, (Eds.). Ottawa, Ont., 19-23 Aug. 1991. Forestry Canada. pp. 89-90.
(Cone induction using gibberellin $GA_{4/7}$ on black spruce (*Picea mariana*) and white pine (*Pinus strobus*) is discussed. Explant culture of black spruce and somatic embryogenesis of spruces is also discussed.)

HO, R. H. (1991). Promotion of cone production in potted black-spruce grafts, using gibberellins, heat-treatment and root-pruning. For. Ecol. Manage. 40:261-269.
(Potted 3-year-old grafts of black spruce at different stages of lateral shoot elongation were sprayed with different concentrations of gibberellin $A_{4/7}$ for a total of six weeks in a heated greenhouse to enhance seed-cone production. A combination of heat-treatment and root-pruning appeared to have an adverse effect on cone production. Pollen viability was not affected by the treatment.)

HO, R. H. (1991). Timing of gibberellin $A_{4/7}$ application for cone production in potted black spruce grafts. Can. J. For. Res. 21(7): 1137-1140.
(Potted 5-year-old grafts of black spruce (*Picea mariana* (Mill.) B.S.P.) growing in either a heated greenhouse or an outdoor holding area were sprayed weekly with gibberellin $A_{4/7}$ for various durations and timings. The application began one to six weeks after vegetative bud break and continued until the end of lateral shoot elongation.)

HOOD, J. (1991). Biology to policy: Casting pearls to swine. *In* Maintaining Diversity: "Should We Be Concerned?" S. Magnussen, J. Lavereau and T. J. Boyle, (Eds.). Ottawa, Ont., 19-23 Aug. 1991. Forestry Canada. p. 22.
(Increased international exchange of forest tree seeds and cuttings led to, in the 1960s to 1970s, the first "official" guidelines for movement and/or trade. Sweden and Germany put into place regulations governing the production and trade of clonal material in 1982 and 1985. Denmark, Belgium, New Zealand, Canada and Ontario have since followed suit, with either policy, guidelines, a proposal or a discussion paper. Pertinent details of these efforts are compared and contrasted.)

KOPPENAAL, R. S., S. J. COLOMBO and (E. BLUMWALD). (1991). Acquired thermotolerance of jack pine, white spruce and black spruce seedlings. Tree Physiol. 8:83-91.
(High surface temperatures frequently occur on boreal planting sites during summer and have been directly implicated in coniferous seedling mortality and plantation failure. The purpose of this project was to determine the capacity for, and duration of, acquired thermotolerance in first-year jack pine, white spruce and black spruce seedlings following hardening at supraoptimal temperatures.)

(KOPPENAAL, R. S.), (T. J. TSCHAPLINSKI) and S. J. COLOMBO. (1991). Carbohydrate accumulation and turgor maintenance in seedling shoots and roots of two boreal conifers subjected to water stress. Can J. Bot. 69(11): 2522-2528.
(Water potential components and organic solutes were examined in shoots and roots of potted jack pine (*Pinus banksiana* Lamb.) and white spruce (*Picea glauca* (Moench) Voss) seedlings after exposure to seven days of water stress. Osmotic adjustment in the roots and shoots of these two boreal conifers suggests that preconditioning planting stock by exposure to water stress may increase carbohydrate concentrations and enhance seedling drought tolerance.)

MACDONALD, G. B. (1991). A comparison of new proximity-based expressions of competing vegetation. OMNR For. Res. Rep. No. 126: 17 p. (OMNR 4704)
(Indices of interspecific competition from perennial vegetation were formulated and tested for their ability to explain variation in the diameter increment of black spruce (*Picea mariana* (Mill.) B.S.P.) and jack pine (*Pinus banksiana* Lamb.) seedlings. The indices were derived from either vertical hemispherical photographs or field measurements. The optimum index was calculated as

the amount of competing canopy on a vertical hemispherical photograph in relation to the seedling leaf area.)

MACDONALD, G. B. (1991). Reliability of balsam fir growth and yield estimates based on black spruce normal yield tables. OFRI For. Res. Note No. 48: 4 p. (OMNR 4726)
(The normal yield tables developed by Plonski (1956, 1974) are used routinely by forest managers in Ontario. Since balsam fir is not included in the tables, this study examines the validity of applying Plonski's black spruce normal yield tables to obtain growth and yield estimates for balsam fir in northern Ontario.)

MOHAMMED, G. H. (1991). Forest renewal research and development needs survey. OFRI For. Res. Info. Paper No. 105: 20 p. (OMNR 4786)
(The survey described in this report solicited input from major clients of the OMNR Forest Renewal Group on the establishment of research priorities. Key research needs were in the areas of overwintering planting stock, assessment of physiological quality and stress levels, drought conditioning, development of non-herbicidal approaches for post-planting vegetation control, growth and yield, seed viability and germination, and comparison of stock types.)

MORRIS, D. M. and R. FORSLUND. (1991). A field-oriented competition index for young jack pine plantations and a computerized decision tool for vegetation management. New Forests 5: 93-107.
(A field-oriented competition index (shade index) was developed using a series of mensurational measurements on competitors surrounding individual jack pine seedlings. This index and accompanying software were developed for a hand-held microprocessor, allowing for on-site evaluations.)

MORRIS, D. M. and G. B. MACDONALD. (1991). Development of a competition index for young conifer plantations established on boreal mixedwood sites. For. Chron. 67(4): 403-410.
(A competition index was developed, and then used to examine the relationships between perennial competition and plantation performance. Effective canopy cover, derived from vertical hemispherical photographs taken at the base of seedling leaders, provided an accurate estimate of the perennial woody competition affecting seedling diameter growth.)

PATERSON, J. M. (1991). Field performance of black spruce container stock. Number 1. Comparison of two growing environments and four container types—Second-year field results from 1989 outplanting. OMNR For. Res. Rep. No. 127: 10 p. (OMNR 4785)
(Black spruce (*Picea mariana* (Mill.) B.S.P.) overwintered container crops produced in four container types (FH408 Paperpot, Multi-pot #1-67, Multi-pot #3-96, Multi-pot #6-45) and two growing environments (greenhouse and outdoors) were compared in outplanting trials during the spring of 1989.)

TEMPLETON, C. W., K. D. ODLUM and S. J. COLOMBO. (1991). How to dissect spruce buds. OFRI Brochure. (OMNR 4702)
(The techniques for the dissection of spruce buds described and pictured in this brochure will allow nursery managers to assess bud formation status in their tree seedling crops.)

WAGNER, R. G. (1991). Ontario's approach to improving the management of forest vegetation. Forestry on the Hill 1991/05: 1-6.

(The Vegetation Management Alternatives Program, also known, as VMAP, is outlined under the headings of research, education and field delivery.)

WAGNER, R. G. and J. C. ZASADA. (1991). Integrating plant autecology and silvicultural activities to prevent forest vegetation management problems. For. Chron. 67(5): 506-513.
(A better understanding of autecological characteristics of forest weeds would help to decrease the need for herbicide use for stand tending, while maintaining or increasing reforestation success.)

WEINGARTNER, D. H. (1991). Spacing and thinning in aspen and mixedwood: some thoughts, theories and observations. *In* Space to Grow: Spacing and Thinning in Northern Ontario. Proceedings of a Symposium Sponsored by Forestry Canada, Ontario Region, and the Ontario Ministry of Natural Resources, V. F. Haavisto, C. R. Smith and C. Mason, (Eds.). Sault Ste. Marie, Ont., 18-20 June 1990. Joint Report 15. pp. 145-149. 5 p.
(Precommercial thinning or spacing of aspen may be required to maintain or enhance stand vigor in the rotation. In boreal mixedwoods, this early release can provide an increase in the coniferous component or accelerate the growth of planted conifers, and can also maintain the value of the stand for wildlife habitat.)

(WIANT, H. V., JR.), (G. B. WOOD) and R. FORSLUND. (1991). Comparison of centroid and paracone estimates of tree volume. Can. J. For. Res. 21(5): 714-717.
(The two methods are shown to provide similar volume estimates. The paracone method is the simplest of the two, and the centroid method provides better merchantable volume estimates for smaller stems.)

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